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Sapera LT™
User's Manual

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Introduction

Overview of Sapera LT Manuals

Sapera LT is supported by the following manuals in printed (with one exception), PDF, and compiled HTML help formats.

- **Sapera LT User's Manual**
  Introduces Sapera LT and provides a general overview of its usage as well as installation procedures.
- **Sapera++ Programmer's Manual**
  Describes in detail all the Sapera++ Basic and GUI classes. Sapera++ is based on the C++ language.
- **Sapera Basic Modules Reference Manual**
  Lists in detail the Sapera LT low-level module functions as well as data definitions, file formats, and macros (based on the C language). This manual is not offered in printed format.
- **Sapera ActiveX Controls Programmer's Manual**
  This manual explains how to program Sapera ActiveX controls.
- **Sapera Acquisition Parameters Reference Manual**
  Describes the acquisition parameters and capabilities. This manual complements the manuals that describe the different Sapera APIs (C, C++, Active X).

Sapera LT supports some hardware specific extensions (also referred to as board specific modules). The following manuals, which are supplied with the corresponding hardware, describe the hardware functionality and the supporting API.

- **Sapera CAB Programmer's Manual**
  This manual introduces CAB (DALSA Coreco Auxiliary Bus) and explains how to implement it into a functional system. It also describes the programming API.
- **Sapera Pixel Processor Modules Programmer's Manual**
  This manual describes the Pixel Processor and its modules.

About the Manual

This manual exists in printed, Windows Help, and Adobe Acrobat® (PDF) formats. The Help and PDF formats make full use of hypertext cross-references. The PDF format offers links to the DALSA home page on the Internet, located at **http://www.imaging.com**, which contains documents, software updates, demos, errata, utilities, and more.

Using the Manual

File names, directories, and Internet sites will be in bold text (for example, **setup.exe**, **c:\windows**, **http://www.imaging.com**).

Source code, code examples, and text that must be entered using the keyboard will be in typewriter-style text (for example, `[PixelClock]`).

Menu and dialog actions will be indicated in bold text in the order of the instructions to be executed, with each instruction separated by bullets. For example, going to the **File** menu and choosing **Save** would be written as **File•Save**.

Getting Started

About Sapera LT

Sapera LT is a high-level C++ class library dedicated to image processing and machine vision. The C++ library API (Application Programming Interface) is composed of two different groups of classes:

- Basic Classes
- GUI Classes

The **Basic Classes** constitute the core of the Sapera++ API. They may be subdivided as follows:

- Manager Classes provide image device management functionality.
- Hardware Independent Classes provide everything you need to acquire, display and access images without worrying about specific hardware.
- Board Specific Classes provide the hardware specific support functions. The Pixel Processor and the Coreco Auxiliary Bus (CAB) modules are examples of Sapera LT hardware specific extensions. Additional documentation is provided with the related hardware products.

Hardware independent classes allow one application to control different DALSA devices through the same API. It also guarantees seamless migration to any future DALSA hardware product supported by Sapera LT. The modular architecture provides the user with high programming flexibility and readability.

The **GUI classes** include a set of Microsoft® Foundation Classes (MFC) based dialog boxes designed to implement some of the most commonly used tasks for Sapera LT applications, such as loading an acquisition configuration file. They, however, do not constitute an official API. Rather, they are provided 'as is' with source code so that you may modify them at your discretion.

Sapera Products

Two different Sapera packages are available:

- Sapera LT
- Sapera Processing

Sapera LT includes everything you need to acquire and display images. It is targeted at developers that have their own image processing libraries and want to interface those libraries to a Sapera LT compatible device. Sapera LT includes tools such as CamExpert and the Sapera LT Application Wizard to speed up application development.

Sapera Processing is DALSA's comprehensive C++ library for image processing and analysis.

Note: Despite the similarity in product names, these are two completely different products. They are independent of one another, yet they can be used together to implement a complete image acquisition, display, processing, and analysis solution. Refer to the *Sapera Processing Programmer's Manual* for a detailed description of Sapera Processing.

TWAIN Support

Initially developed to provide a standard software interface to image scanners, the TWAIN standard has evolved into the imaging industry.

The TWAIN standard is a generic software interface between an application and an imaging device.

Sapera LT runtimes provide TWAIN support that allows a user to control DALSA devices through the TWAIN interface without having to directly program any Sapera API.

Microsoft® DirectShow® Support

Sapera LT runtimes include a Microsoft® DirectShow® compatible driver that allows any Sapera LT supported frame grabber to act as a DirectShow® video source.

Requirements

Below is a list of the components required by Sapera LT.

Minimum System Requirements

- PCI-bus IBM PC or compatible with Pentium class or later processor
- Windows® 2000, Windows® XP (**Note:** Windows NT 4.0 and Embedded are no longer officially supported)
- One of the following C/C++ language compilers:
  - Visual C++ version 6.0
  - Visual C++ .NET 2003
  - Visual C++ 2005
  - Borland C++ Builder version 6.0 or later

OR

- One of the following environments that support ActiveX technology:
  - Visual Basic 6.0
  - Visual Studio .NET 2003
  - Visual Studio 2005
  - Borland Delphi version 7

Hardware Requirements (optional)

- One of several Sapera LT compatible devices (frame-grabber, processing board or camera).
- Corresponding Sapera LT-compatible device drivers.

Installation Procedure

Note: Before installing Sapera LT, make certain that your current VGA display mode is set to display at least 256 colors. Some Sapera LT features require DirectDraw™, which will not work with a smaller number of display colors.

The following steps describe how to install Sapera LT onto your hard drive:

1. Insert the Sapera LT installation CD-ROM in a CD-ROM drive.
2. A CD Browser screen will appear automatically. If not, from Windows Explorer, run the **launch.exe** application located in the root directory of the Sapera LT CD.
3. Go to the **Sapera LT Installation** menu to begin Sapera LT installation.
4. Launch Sapera LT installation and follow the on-screen instructions.
5. During the installation, you will be prompted to enter the Sapera LT product key. This key is provided on the Sapera LT CD case, the package box, the manuals, and on a separate sticker.
6. You can install the required board or camera drivers without rebooting the computer at this time; however, you must reboot the computer to finish the installation of Sapera.
7. Reinsert the Sapera LT CD or run the **launch.exe** application again.
8. Go to the **Hardware Device Drivers** menu to install the required drivers for your installed Sapera LT supported hardware.
9. Reboot the computer when prompted to complete the software installation.

File Locations

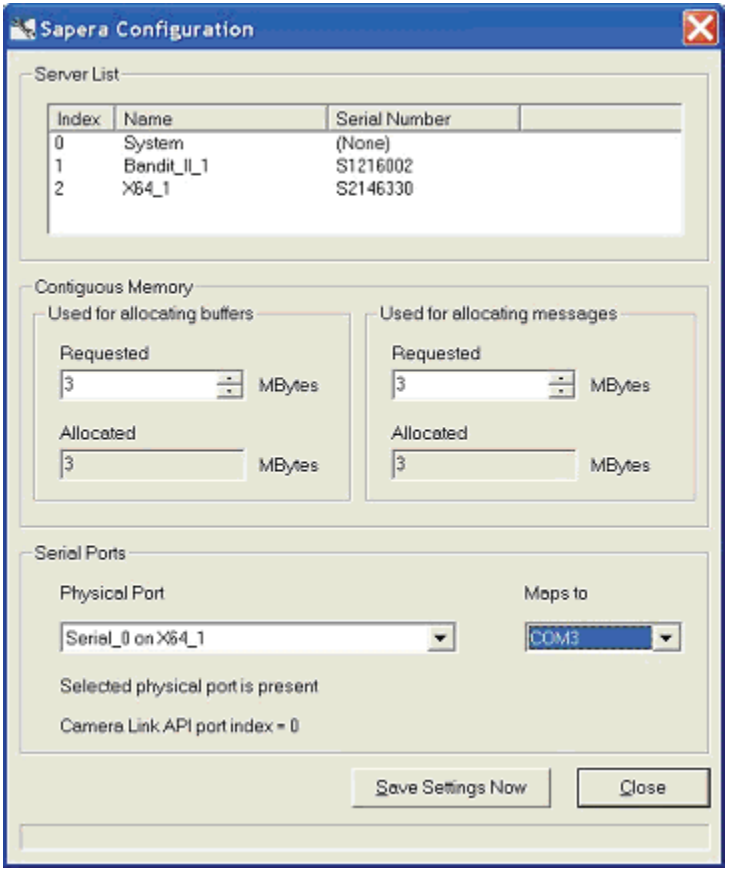
The table below lists the different file groups and locations:

Description	Location
Utility programs	**\Sapera\Bin**
Acquisition configuration files	**\Sapera\CamFiles** (and device-specific subdirectories)
CamExpert utility	**\Sapera\CamExpert**
Sapera++ include files and GUI classes source code	**\Sapera\Classes**
ActiveX controls (OCXs)	**\Sapera\Components\ActiveX**
Diagnostic tool	**\Sapera\CorDiag**
Demonstration programs	**\Sapera\Demos**
Example programs	**\Sapera\Examples**
Font files	**\Sapera\Fonts**
Help files	**\Sapera\Help**
Image files	**\Sapera\Images**
Header files	**\Sapera\Include**
Import libraries	**\Sapera\Lib**
Pixel processor high level library source code	**\Sapera\Pixpro**
Dynamic-link libraries (DLLs)	Windows system directory (**windows\system32**)
Device driver files	Windows driver directory (**windows\system32\drivers**)

Using Sapera LT

Configuring Sapera LT

The **Sapera LT Configuration** program (**SapConf.exe)** allows you to see all the Sapera LT-compatible devices present within your system, together with their respective serial numbers. It may also be used to adjust the amount of contiguous memory to be allocated at boot-time. After activating this program, it displays all the servers related to the installed devices as shown in the figure below.



The **System** entry represents the system server. It corresponds to the host machine (your computer), and is the only server that should always be present. The other servers correspond to the device's present within the system. See "Supported DALSA Devices" on page 67 for a current list of Sapera LT supported devices.

Configuring Contiguous Memory

The **Contiguous Memory** section lets you specify the total amount of contiguous memory to be reserved for allocating **buffers** and **messages**.

Note: All Sapera LT demos and examples **do not use contiguous memory**. Therefore, you should not modify these settings unless your application requires contiguous memory.

The **Requested** value displays what was requested. The **Allocated** value displays the amount of contiguous memory that was allocated successfully. The current value for **buffers** determines the total amount of contiguous memory reserved at boot-time for the allocation of dynamic resources (for example, buffers, lookup tables, kernels). Adjust this value according to the need of your application for contiguous memory. The current value for **messages** determines the total amount of contiguous memory reserved at boot-time for the allocation of messages. This memory space is used to store arguments when a Sapera LT function is called. Increase this value if you are using functions with large arguments, such as arrays.

Configuring Frame Grabber Board Serial Ports

Certain frame grabber boards provide an onboard serial port for direct camera control by the frame grabber. Refer to the specific board user manual for information on how to configure and use it.

Using the CamExpert Tool

Overview

Sapera LT applications need to load the appropriate acquisition configuration file before acquiring images from a camera. The camera configuration file has the extension **.ccf** .

CamExpert, provided with Sapera LT, supplies sets of **predefined camera files** for the most common camera types (including NTSC and PAL). Use CamExpert to generate a CCF file in which you have a camera for which there are currently no available CAM files.

Features

- Supports all DALSA hardware currently supported by Sapera LT.
- Creates and modifies camera configuration (CCF or CCA/CVI) files.
- Groups acquisition parameters into related categories for easier access to any specific parameter.
- Intelligent editing of video timings through a locking mechanism that allows explicit modification of some values and automatic recalculation of the remaining ones.
- Online operation mode that allows live acquisition of images as the parameters are specified and modified.
- Online context-sensitive help system.

Additional Information

For additional information about Sapera acquisition parameters, refer to the *Sapera Acquisition Parameters Reference Manual*.

See either the corresponding device user's manual or search within this manual for limitations applicable to specific DALSA hardware.

Demos and Examples

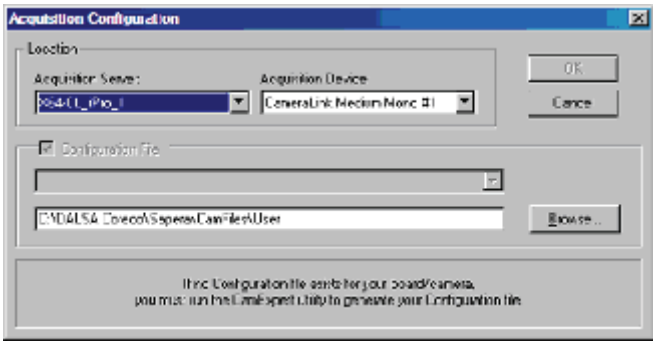
Several generic demos and examples come with Sapera. A description is provided for each in this section.

Certain device driver installations provide other demos and examples that demonstrate the specific usages and capabilities of the device. Refer to a specific device user's manual for further details.

Acquiring with Grab Demo

The Sapera LT Grab Demo program allows you to grab and display a live image in a host buffer. It can accommodate any Sapera-compatible board with any camera. This demo is a good starting point to verify that your camera and frame grabber are properly installed.

The following dialog box appears when starting Grab Demo:

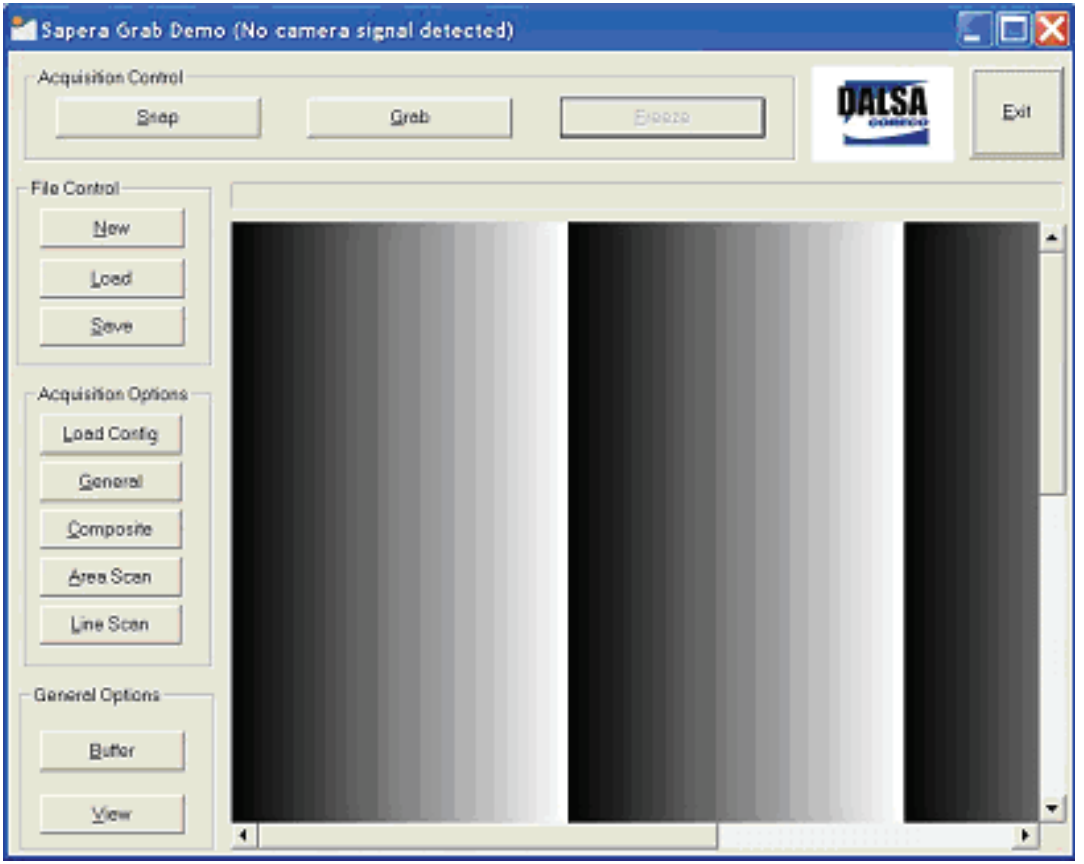


You must select the *Acquisition Server* and the *Acquisition Device*. The first one corresponds to the board you want to grab from; the second represents the acquisition device on this board (some boards may have more than one).

You must then select an acquisition configuration file (CCF File) compatible with your camera from the list of available files. CamExpert must be used to generate CCF files (for example, external trigger, cropping window, and so forth).

Note: No frame grabber was found within your system if this dialog box does not appear. In such a case, verify that the device driver corresponding to your frame grabber was correctly installed. The **Sapera LT Configuration Program** gives you a list of boards present within your system. This demo can work without a frame grabber. It, however, only allows you to load the file from the disk.

Click **OK** to start the demo.



By using Grab Demo you can now:

- Control the acquisition using the **Snap**, **Grab**, **Freeze,** and **Abort** buttons.
- Load/save images from/to disks using the **Load** and **Save** buttons.
- Dynamically adjust the acquisition parameters through the **General**, **Area scan**, **Linescan**, and **Composite** buttons.
- Reload the CCF file using the **Load Config** button (this overwrites all the parameters modified in step 3).
- The **Buffer** button allows you to change the number of buffers used for internal cycling and the type of buffer used (contiguous, scatter-gather, off-screen, or overlay).

Description of Examples

Several example programs are available within Sapera. They are essentially basic applications demonstrating simple tasks like grabbing an image and loading an image file from the disk.

The main purpose of the examples is to provide the user with code samples that can be easily extracted and integrated into an application.

All the examples are included in the following projects:

`Sapera\Examples\Classes\SapExamples.dsw` (for Microsoft Visual C++ 6.0)
`Sapera\Examples\Classes\SapExamples_2003.sln` (for Microsoft Visual C++.NET 2003)
`Sapera\Examples\Classes\SapExamples_2005.sln` (for Microsoft Visual C++ 2005)
`Sapera\Examples\Classes\SapExamples.bpg` (for Borland C++ Builder)

These projects allow you to recompile all the examples in a batch.

The table below describes the different example programs:

FileLoadCPP Example

This example shows how to load an image file from the disk into a Sapera buffer and then display it. The buffer is created according to the image file properties. One of several images (monochrome, RGB, or YUV) can be selected for loading. This example uses the Sapera C++ API.

FileLoadMFC Example

Same as the FileLoadCPP Example, but additionally uses the Sapera++ GUI classes allowing file browser usage.

GrabCPP Example

This example shows how to grab an image from a selected camera into a Sapera buffer and then display it. The buffer is created according to the camera settings. Any Sapera compatible frame grabber can be used. This example uses the Sapera C++ API.

GrabMFC Example

Same as GrabCPP but additionally uses the GUI Sapera++ classes to allow for board and camera selection using dialog boxes.

ColorSplit Example

Shows how to split and merge color images into single monochrome components. An RGB image is loaded, split into three monochrome components, then a simple processing is applied to the three components before they are merged back to RGB as output.

Description of Demos

Several demo programs are available with Sapera. They are more complete applications than the supplied examples. There are demos that cover both Sapera++ and the ActiveX controls.

The demos main purpose is to provide the user with a starting application that can be modified in order to become the user's end application.

A Visual Studio 6.0 workspace (**\Sapera\Demos\Classes\Vc\SapDemos.dsw**) and a Visual Studio .NET 2003 solution (**\Sapera\Demos\Classes\Vc\SapDemos_2003.sln**) include all Sapera++ demo projects. They allow you to recompile all the demos in a batch, together with the Sapera++ GUI Classes.

The following describes the different Sapera++ demo programs. See the *Sapera++ Programmer's Manual* for more information on the Sapera++ API.

Grab Demo (Dialog Box Interface)

\Sapera\Demos\Classes\Vc\GrabDemo\Release\GrabDemo.exe

This program demonstrates the basic acquisition functions included in Sapera++. It allows you to acquire images, either in continuous or in one-shot mode, while adjusting the acquisition parameters.

The minimum requirements to run this demo are a Sapera-compatible frame grabber and an analog or digital camera.

The supplied executable is built using Visual Studio .NET 2003, plus the MFC library.

Grab Demo (Single Document Interface)

\Sapera\Demos\Classes\Vc\GrabDemoSDI\Release\GrabDemoSDI.exe

This program demonstrates the basic acquisition functions included in Sapera++. It allows you to acquire images, either in continuous or in one-shot mode, while adjusting the acquisition parameters.

The minimum requirements to run this demo are a Sapera-compatible frame grabber and an analog or digital camera.

The supplied executable is built using Visual Studio .NET 2003, plus the MFC library.

Grab Demo (Multiple Document Interface)

\Sapera\Demos\Classes\Vc\GrabDemoMDI\Release\GrabDemoMDI.exe

This program demonstrates the basic acquisition functions included in Sapera++. It allows you to acquire images, either in continuous or in one-shot mode, while adjusting the acquisition parameters. You can open multiple windows to simultaneously acquire and display images from separate cameras.

The minimum requirements to run this demo are a Sapera-compatible frame grabber and an analog or digital camera.

No shortcut to this demo is provided in the **Start** menu for Sapera LT. However, an executable built using Visual Studio .NET 2003 and the MFC library is supplied under the \Sapera\Demos\Classes\Vc\GrabDemoMDI directory.

Sequential Grab Demo

\Sapera\Demos\Classes\Vc\SeqGrabDemo\Release\SeqGrabDemo.exe

This program demonstrates how to grab a sequence of images into memory and then display them. The program allows you to record several images and then load and save AVI files. Each image is stored in its own buffer and can be reviewed. A small number of images are allocated by default, but they can be increased using the buffer options inside the demo.

The minimum requirements to run this demo are a Sapera-compatible frame grabber and an analog or digital camera.

No shortcut to this demo is provided in the **Start** menu for Sapera LT. However, an executable built using Visual Studio .NET 2003 and the MFC library is supplied under the \Sapera\Demos\Classes\Vc\GrabDemoMDI directory.

Bayer Demo

\Sapera\Demos\Classes\Vc\BayerDemo\Release\BayerDemo.exe

This program demonstrates the Bayer conversion functionality included in Sapera++. It allows you to acquire images, either in continuous or in one-shot mode, while adjusting the acquisition parameters. It includes interactive control of Bayer conversion parameters. You may optionally apply Bayer filtering to acquired images.

The minimum requirements to run this demo are a Sapera-compatible frame grabber and an analog or digital monochrome camera.

The supplied executable is built using Visual Studio .NET 2003, plus the MFC library.

Flat-field Demo

\Sapera\Demos\Classes\Vc\FlatFieldDemo\Release\FlatFieldDemo.exe

This program demonstrates the flat-field correction functionality included in Sapera++. Flat Field Correction (FFC) includes Fixed Pattern Noise (FPN), Pixel Replacement, Photo Response Non Uniformity (PRNU), and Shading Correction. The demo allows you to acquire images, either in continuous or in one-shot mode, while adjusting the acquisition parameters. It includes interactive calibration of flat-field gain and offset settings. You may optionally apply flat-field correction to acquired images.

The minimum requirements to run this demo are a Sapera-compatible frame grabber and an analog or digital monochrome camera.

The supplied executable is built using Visual Studio .NET 2003, plus the MFC library.

I/O Demo

\Sapera\Demos\Classes\Vc\IODemo\Release\IODemo.exe

This program demonstrates the usage of General I/O functionality included in Sapera++. It allows you to monitor the current state of the input and output pins, and change their state between low and high polarity. It also allows you to monitor interrupts on the input pins, and to count the number of incoming interrupts.

The minimum requirements to run this demo are a Sapera-compatible board with General I/O capabilities.

The supplied executable is built using Visual Studio .NET 2003, plus the MFC library.

GigE-Vision Camera Demo

\Sapera\Demos\Classes\Vc\GigeCameraDemo\Release\GigeCameraDemo.exe

This program demonstrates how to acquire images from a DALSA GigE Vision™ camera. The demo allows either to load a configuration file (previously generated by CamExpert) or to use the camera defaults.

The minimum requirement to run this demo is a Sapera-compatible GigE-Vision camera.

The supplied executable is built using Visual Studio .NET 2003, using the MFC library.

Sapera LT also includes demos that use ActiveX controls. A Visual Basic 6.0 project group (**\Sapera\Demos\ActiveX\Vb6\SapActiveXDemos.vbg**), Visual Studio .NET 2003 solution (**\Sapera\Demos\ActiveX\.NET\SapActiveXDemos.sln**), and Delphi 7 package solution (**\Sapera\Demos\ActiveX\Delphi\SapActiveXDemos.bpg**) include all ActiveX demo projects.

The following describes the different Sapera LT ActiveX demo programs. . See the *Sapera LT ActiveX Controls Manual* for more information on the ActiveX controls.

Acquisition Demo (Visual Basic 6.0)

\Sapera\Demos\ActiveX\Vb6\AcqDemo\AcqDemo.exe

This program demonstrates the basic acquisition functions included in the Sapera LT ActiveX controls. It allows you to load an acquisition file and then acquire images, either in continuous or in one-shot mode. Clicking the right mouse button over the image display area allows you to modify the acquisition control properties as well as loading and saving images.

The minimum requirements to run this demo are a Sapera-compatible frame grabber and an analog or digital camera.

The supplied executable is built using Visual Basic 6.

Acquisition Demo (VB.NET)

\Sapera\Demos\ActiveX\.NET\VbAcqDemo\VbAcqDemo.vbproj

This program demonstrates the basic acquisition functions included in the Sapera LT ActiveX controls. It allows you to load an acquisition file and then acquire images, either in continuous or in one-shot mode. Clicking the right mouse button over the image display area allows you to modify the acquisition control properties as well as loading and saving images.

The minimum requirements to run this demo are a Sapera-compatible frame grabber and an analog or digital camera.

Acquisition Demo (C#)

\Sapera\Demos\ActiveX\.NET\VsAcqDemo\VsAcqDemo.csproj

This program demonstrates the basic acquisition functions included in the Sapera LT ActiveX controls. It allows you to load an acquisition file and then acquire images, either in continuous or in one-shot mode. Clicking the right mouse button over the image display area allows you to modify the acquisition control properties as well as loading and saving images.

The minimum requirements to run this demo are a Sapera-compatible frame grabber and an analog or digital camera.

Acquisition Demo (Delphi 7)

\Sapera\Demos\ActiveX\Delphi\AcqDemo\AcqDemo.dpr

This program demonstrates the basic acquisition functions included in the Sapera LT ActiveX controls. It allows you to load an acquisition file and then acquire images, either in continuous or in one-shot mode. Clicking the right mouse button over the image display area allows you to modify the acquisition control properties as well as loading and saving images.

The minimum requirements to run this demo are a Sapera-compatible frame grabber and an analog or digital camera.

Using the Flat-Field Demo

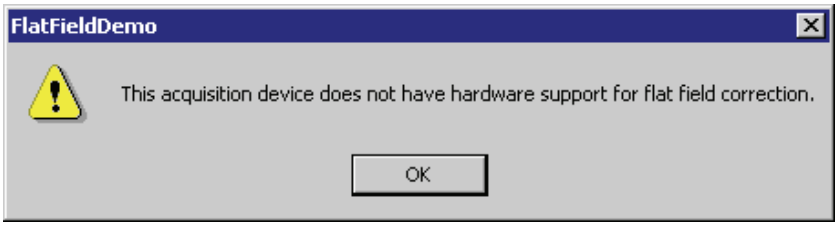
Program	**Start•Programs•DALSA•Sapera LT•Demos•Flat Field Demo**
Program file	**\DALSA Coreco\Sapera\Demos\Classes\vc\FlatFieldDemo\Release\FlatfieldDemo.exe**
Description	This program demonstrates Flat Field (2D Shading Correction) or Flat Line processing (1D Shading Correction), either performed by supporting DALSA hardware or performed on the host system via the Sapera library. The program allows you to acquire a flat field or flat line reference image, and then do real time correction either in continuous or single acquisition mode. The program code may be extracted for use within your own application.
Remarks	This demo is built using Visual C++ 6.0 using the MFC library. It is based on Sapera C++ classes. See the Sapera User's and Reference manuals for more information.

Flat Field Correction is the process of eliminating small gain differences between pixels in a CCD array. When calibrated flat field correction is applied to the image, the CCD exposed to a uniformly lighted field will have no gray level differences between pixels. The Flat Field demo automatically functions both with hardware supporting flat field processing or performs the processing via the Sapera library on the host system processor.

Program Start and Server Selection

Run the demo via the Windows start menu shortcut **Start•Programs•DALSA•Sapera LT•Demos•Flat Field Demo**. The demo program first displays the acquisition configuration menu to select the board acquisition server and acquisition device.

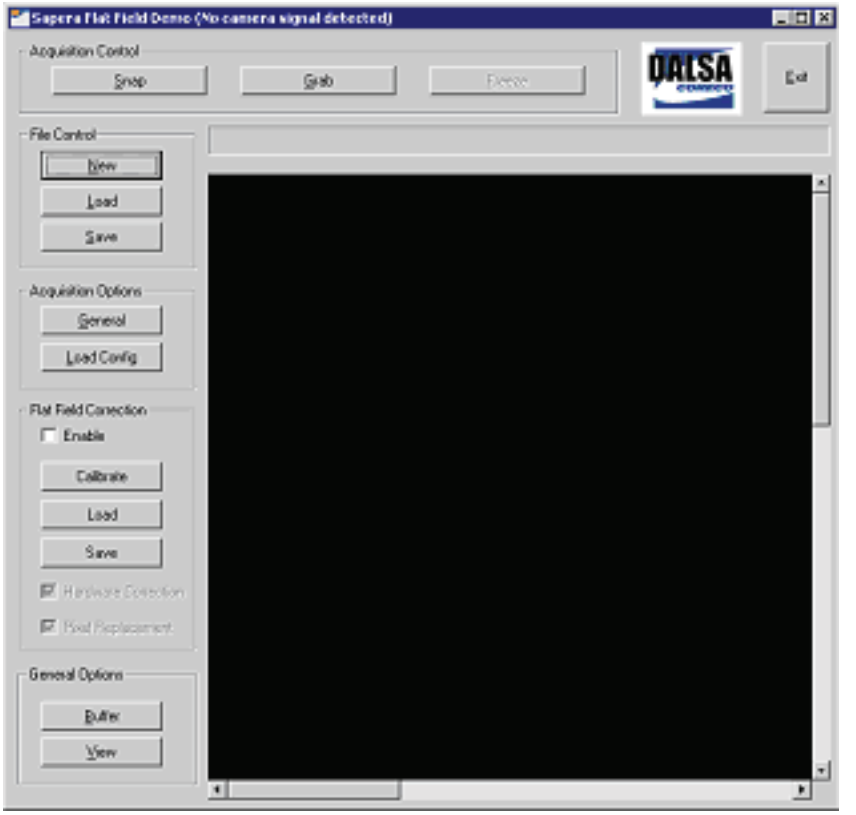
If the selected board does not support onboard flat field processing, a message is displayed (see following figure) stating that processing will be on the host system.



This menu is also used to select the required camera configuration file for the connected camera. For a more detailed description of the acquisition configuration menu see "Acquiring with Grab Demo" on page 12. Sapera camera files contain timing parameters and video conditioning parameters.

Flat Field Demo Main Window

The demo main window provides control buttons and a central area for displaying the grabbed image. Developers can use the demo source code as a foundation to quickly create and test the desired imaging application.



Using Flat Field Correction

The demo has typical file and acquisition controls as previously described for the Grab Demo. What is different is the Flat Field Correction control section which has three buttons and a check box. Follow the procedure described below to setup and use flat field correction.

Verify camera acquisition

First ensure that the camera is functioning and that the acquisition board is capturing live images. The Flat Field Demo provides acquisition controls to confirm image capture.

Enable

Before activating flat field or flat line correction, follow the calibration procedure described in this section (see "Flat Field Calibration" on page 22). To use real time flat field correction, first click in the **Enable** box. Then do image snaps or continuous live grab.

Save

Click on the **Save** button to store files with the flat field gain and offset data gathered with the calibration procedure. Files are saved as .bmp images and can be named as required to reference the camera used.

Load

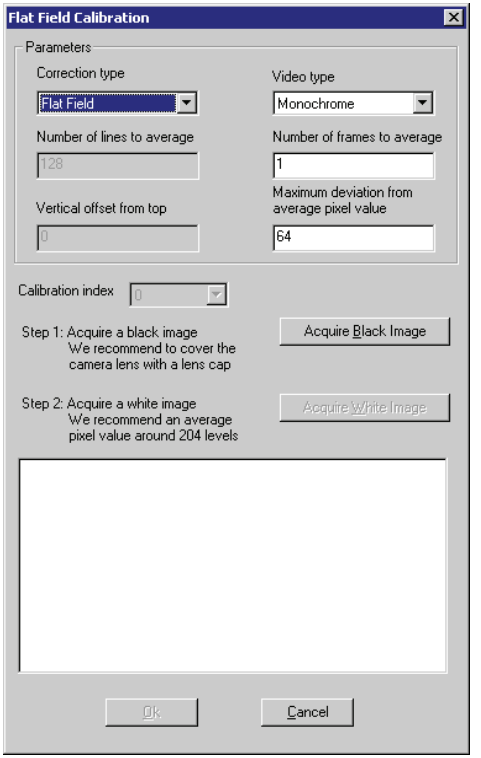
Click on the **Load** button to retrieve files with the flat field gain and offset data gathered with the calibration procedure.

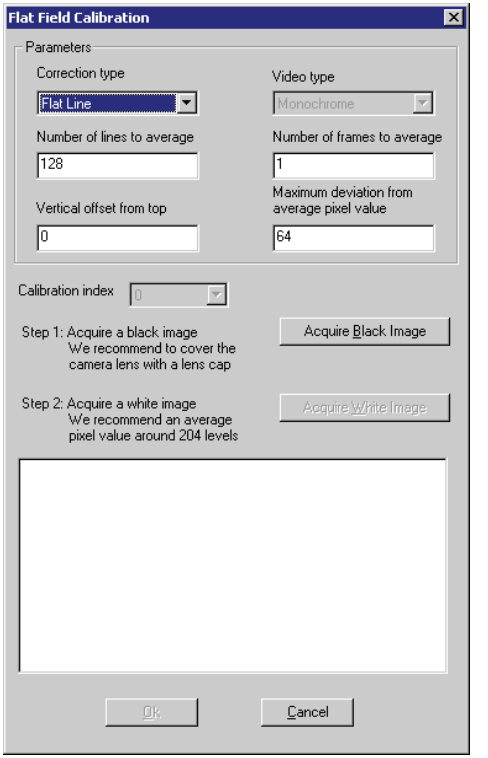
Flat Field Calibration

Calibration is the process of taking two reference images, one of a black field – one of a light gray field (not saturated), to generate correction data for images captured by the CCD. Each pixel data is modified by the correction factor generated by the calibration process, so that each pixel now has an identical response to the same illumination.

The calibration process for an area scan camera can be over the whole frame or a selected number of lines within the frame. For line-scan cameras the user simply selects the number of input lines to average. The calibration control overview follows.

- Click the **Calibrate** button. The calibration window opens as shown. The first figure is the default for an area scan camera. The second figure shows the user selecting a single line for calibration when using an area scan camera.





Setup Before Calibration

- First select the **correction type** to flat field or single flat line. Note that when using a line-scan camera, only flat line calibration is available.
- **Video type** will default to the acquisition type defined in the loaded camera file.
- Set the **number of frames to average** during each calibration step. This should be set to more then one to avoid false data from random pixel noise.
- The field for **maximum deviation from average** defaults to 25% of the gray level range captured, (64 for 8-bit capture, 256 for 10-bit capture, and so forth). This value sets the threshold for detecting static dead pixels – both dark or light. Users will need to adjust this field to best isolate dead pixels from their imaging source.
- When doing a single line calibration to apply to the captured frame, use the two selection fields **number of lines to average** and **vertical offset from top**, to select which video line will be used.

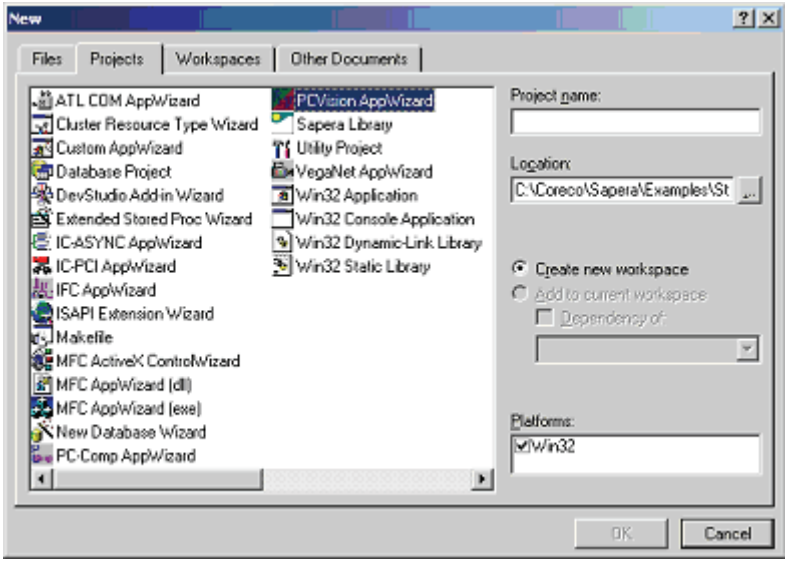
Calibration

- Setup the camera to capture a uniform black image. Black paper with no illumination and the camera lens' iris closed to minimum can provide such a black image.
- Click on **Acquire Black Image**. The flat field demo will grab a video frame, analyze the pixel gray level spread, and present the statistics. If acceptable, use the image as the black reference.
- Setup the camera to acquire a uniform white image (but not saturated white). Even illumination on white paper can be used. It is preferable to prepare for the white level calibration before the calibration procedure.
- Click on **Acquire White Image**. The flat field demo will grab a video frame, analyze the pixel gray level spread, and present the statistics. If acceptable, use the image as the white reference.
- Test the calibration by enabling flat field correction during a live grab. If necessary, adjust the dead pixel detection threshold and repeat the calibration.
- Save multiple versions of calibration data to compare for best imaging or for different imaging setups.

Using the Application Wizard

Step 1 - Overview

The *Sapera LT Application Wizard* allows code generation for simple applications involving a single acquisition device (for example, Bandit-II) in a host computer. It is called from within Microsoft Visual Studio 6, by selecting **File•New** and then selecting the *Projects* tab.



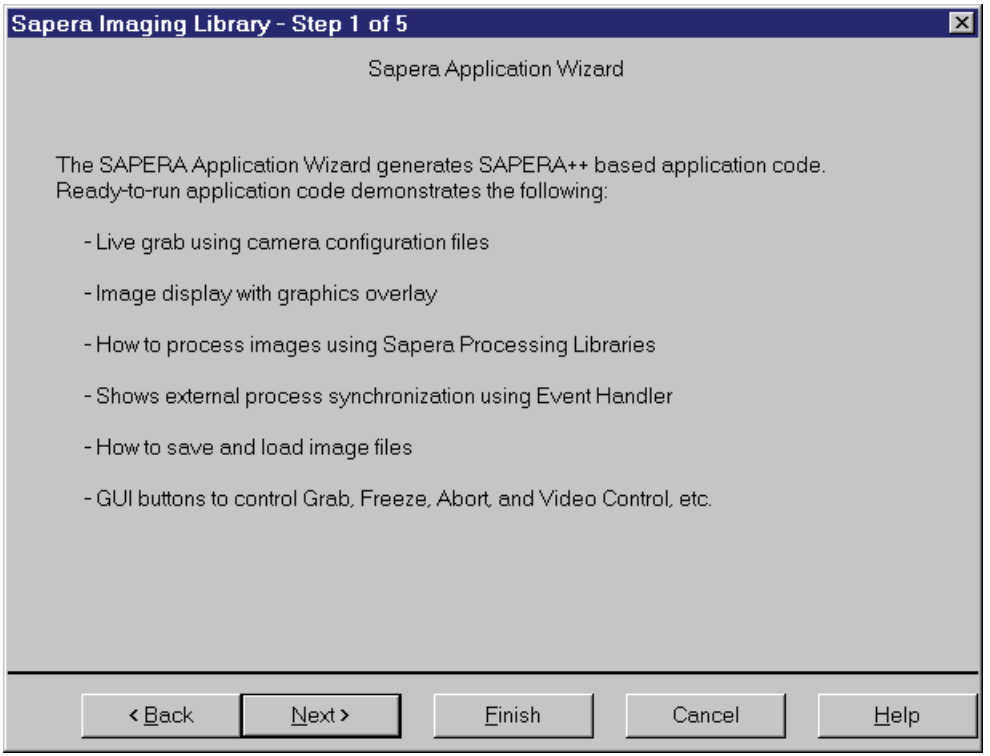
The Sapera LT Application Wizard generates dialog-based MFC applications that use the Sapera++ classes introduced with Sapera 4.0.

Sapera++ Basic Classes encapsulate all Sapera API calls. They address basic imaging concepts, that is, acquisition, display, processing, and buffers.

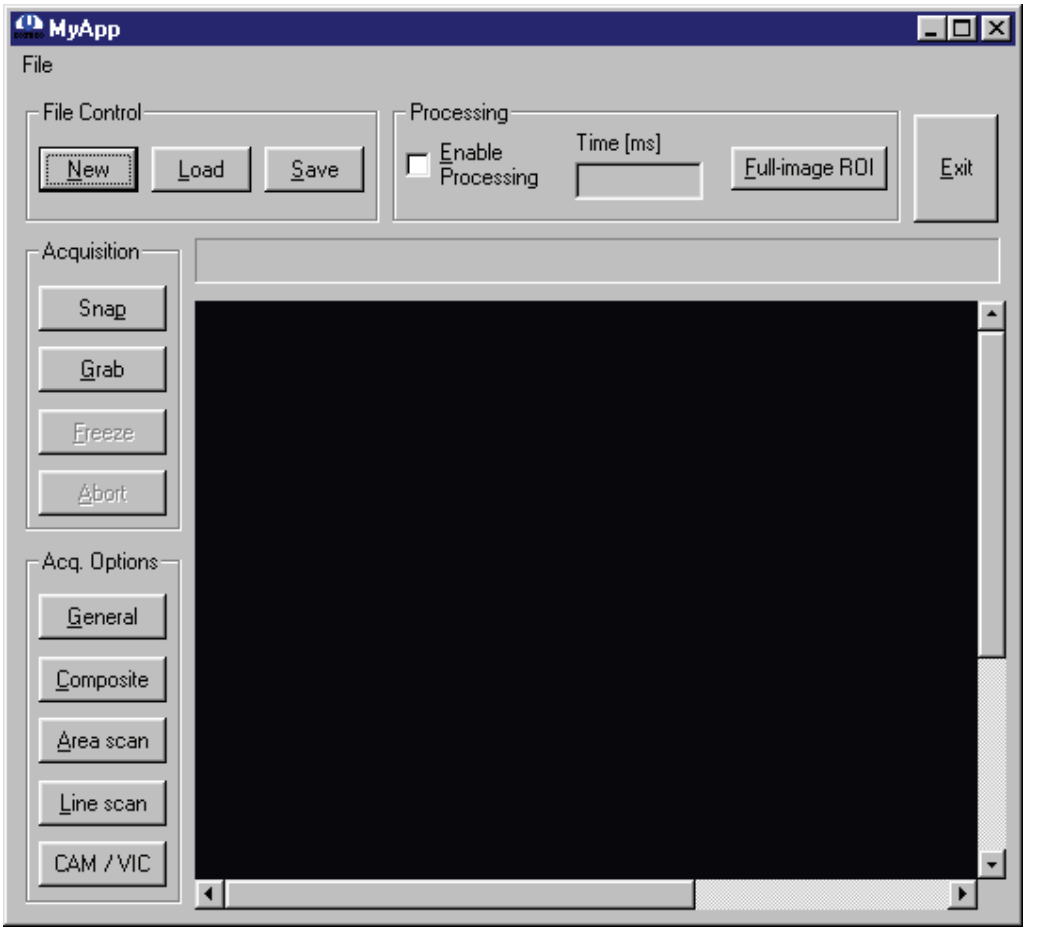
Sapera++ GUI Classes provide the user with MFC-based dialog boxes commonly used in most imaging applications.

Refer to *Sapera++ Programmer's Manual* for information on the classes.

The screen shot below is the first to appear after starting the Sapera LT Application Wizard, and describes what the Sapera LT Application Wizard can essentially do.


Sapera Imaging Library - Step 1 of 5
Sapera Application Wizard
The SAPERA Application Wizard generates SAPERA++ based application code.
Ready-to-run application code demonstrates the following:
- Live grab using camera configuration files
- Image display with graphics overlay
- How to process images using Sapera Processing Libraries
- Shows external process synchronization using Event Handler
- How to save and load image files
- GUI buttons to control Grab, Freeze, Abort, and Video Control, etc.
< Back
Next >
Finish
Cancel
Help

Below is a typical user application interface obtained by using the Sapera LT Application Wizard.



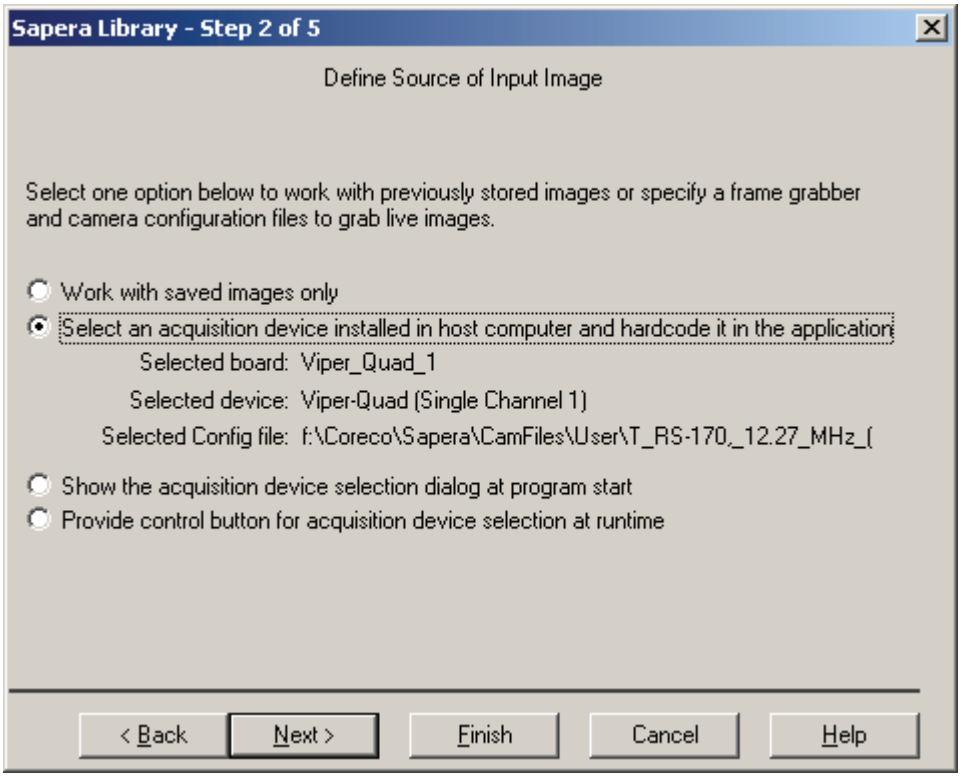
Step 2 - Define Source of Input Image

Location

If the option "*Select an acquisition device installed in host computer...*" is chosen (not available in the stand-alone version) a dialog box is displayed for the user to chose the acquisition server and device immediately. The acquisition server refers to the frame grabber (for example, Viper_Quad_1) while the acquisition device is the name of the input device (for example, Single Channel 1).

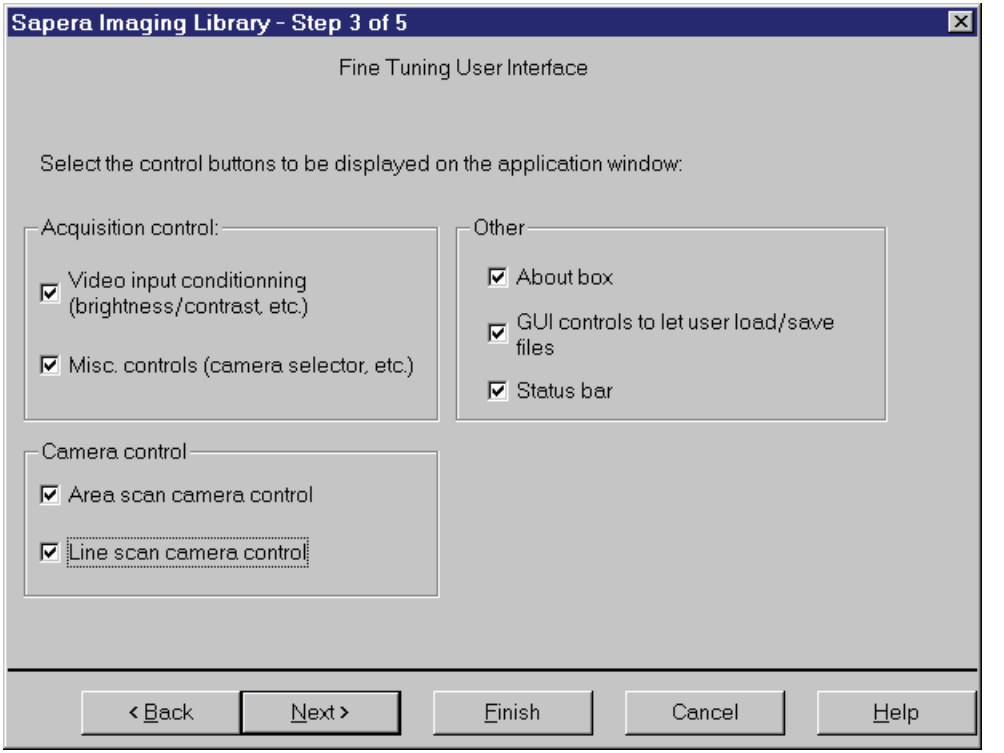
Acquisition Configuration (CCF file)

Prior to release 5.0 of Sapera LT, acquisition was configured using two files: a CAM file (with .cca extension) and a VIC file (with .cvi extension). The two files have been combined into a single CCF file that you can generate using the CamExpert tool. CamExpert uses a large database of CAM files that are distributed with Sapera LT and cover a wide range of camera manufacturers and models.


Sapera Library - Step 2 of 5
Define Source of Input Image
Select one option below to work with previously stored images or specify a frame grabber and camera configuration files to grab live images.
Work with saved images only
Select an acquisition device installed in host computer and hardcode it in the application
Selected board: Viper_Quad_1
Selected device: Viper-Quad (Single Channel 1)
Selected Config file: f:\Coreco\Sapera\CamFiles\User\T_RS-170,_12.27_MHz_(
Show the acquisition device selection dialog at program start
Provide control button for acquisition device selection at runtime
< Back
Next >
Finish
Cancel
Help

Step 3 - Fine Tuning the User Interface

It is sometimes more convenient to set some acquisition parameters individually and directly from within the application rather than using CamExpert. Sapera Classes define a few standard GUI dialog boxes that allow the user to change a selection of frequently used parameters. The screen shot below shows the category list of parameters you can enable.



Below is a brief description of parameters that can be accessed via the different categories:

Video-input-conditioning

- Brightness and contrast options
- Hue and saturation options

Miscellaneous controls

- Camera selector
- Digital input connect bit ordering
- External trigger options

Area scan camera control

- Trigger/reset/integrate options
- Master mode (camera slave) options

Linescan camera control

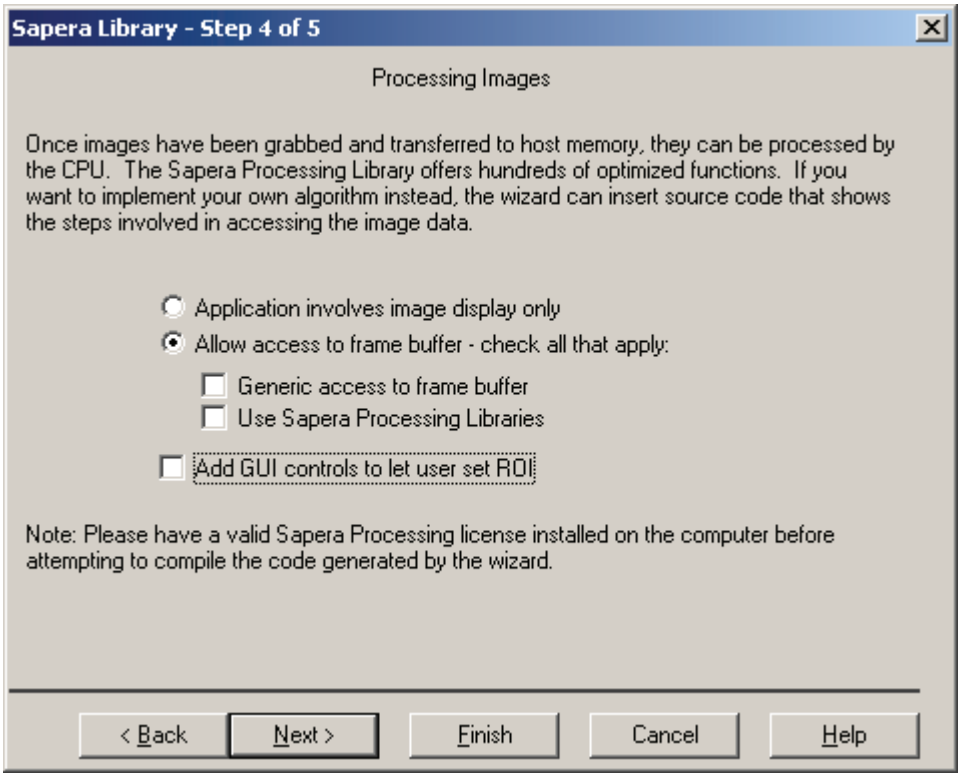
- Line triggering options
- Frame triggering options
- Shaft encoder options
- Linescan direction options

Step 4 - Processing Images

If you do not intend to process images, it is preferable to select "*Application involves image display only*". The application created by this wizard will attempt to transfer the images directly from the acquisition device to the video adapter in order to minimize CPU load.

If you choose to add support for image processing, this wizard will add controls to the application for the user to enable/disable image processing. If the processing is enabled, the processed images will be displayed; otherwise, the unprocessed images will be displayed.

If you select the "*Add GUI controls to let user set ROI*" option, user controls will be added within the application along with the code needed to display the location of the ROI on the image.

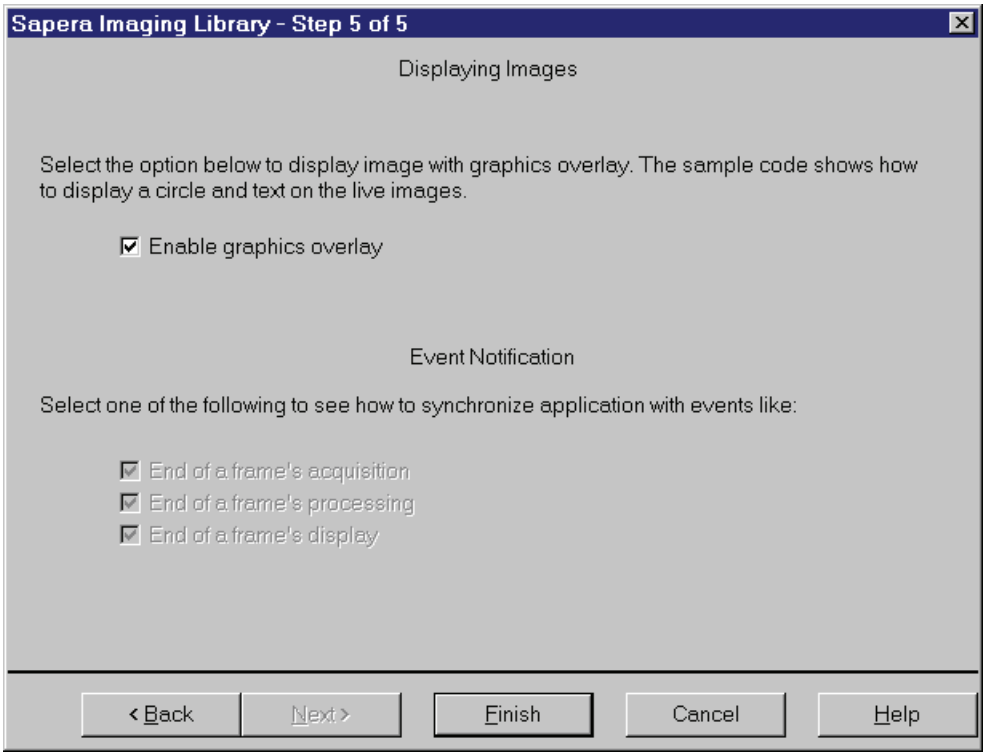

Sapera Library - Step 4 of 5
Processing Images
Once images have been grabbed and transferred to host memory, they can be processed by the CPU. The Sapera Processing Library offers hundreds of optimized functions. If you want to implement your own algorithm instead, the wizard can insert source code that shows the steps involved in accessing the image data.
Application involves image display only
Allow access to frame buffer - check all that apply:
Generic access to frame buffer
Use Sapera Processing Libraries
Add GUI controls to let user set ROI
Note: Please have a valid Sapera Processing license installed on the computer before attempting to compile the code generated by the wizard.
< Back
Next >
Finish
Cancel
Help

Step 5 - Displaying Images

If you select the "*Enable graphics overlay*" option, the wizard will write code that will attempt to use the display adapter's overlay hardware acceleration. If it is not available, then the overlay will be drawn by software for each displayed frame.

Event Notification

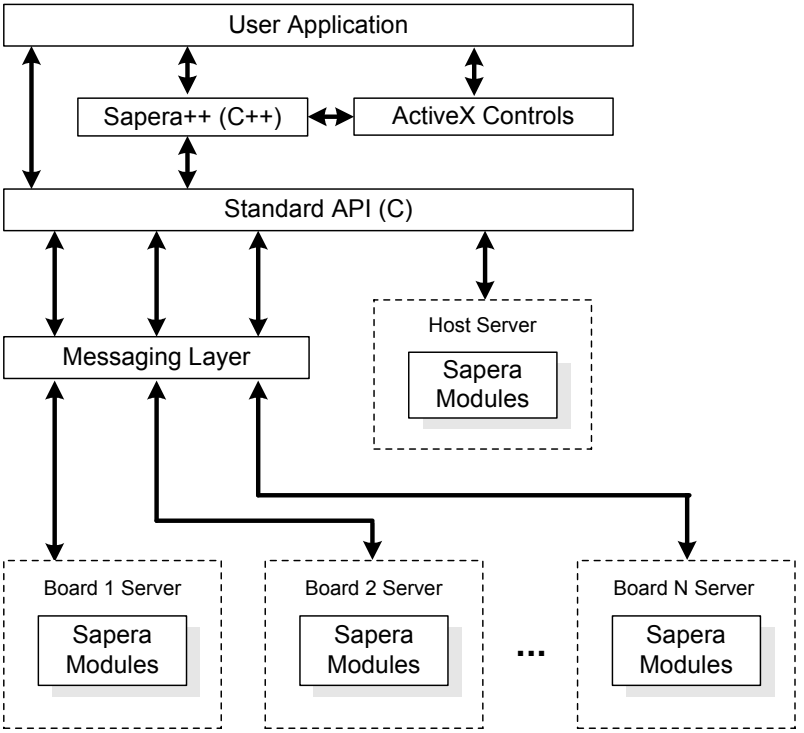
For synchronization purposes, you may register your functions called by Sapera LT at specific events, like at the end of a frame's acquisition. In this step, you can select which events will trigger a Sapera LT Application Wizard written function to be called. Note that some events may have been automatically selected depending on your answers in the previous steps of the wizard.


Sapera Imaging Library - Step 5 of 5
Displaying Images
Select the option below to display image with graphics overlay. The sample code shows how to display a circle and text on the live images.
Enable graphics overlay
Event Notification
Select one of the following to see how to synchronize application with events like:
End of a frame's acquisition
End of a frame's processing
End of a frame's display
< Back
Next >
Finish
Cancel
Help

Sapera LT Architecture

Application Architecture

Whichever API is used (Sapera++, Standard C, or ActiveX), the Sapera LT modular architecture allows applications to be distributed on different Sapera LT servers. Each server can run either on the host computer or on a DALSA device. Sapera LT calls are routed to different servers via the Sapera LT messaging layer in a fashion completely independent to the underlying hardware.



Definition of Terms

What is a server?

A Sapera LT server is an abstract representation of a physical device like a frame grabber, a processing board, a GigE camera or a desktop PC. In general, a DALSA board is a server. Some processing boards, however, may contain several servers; this is true when using multi-processor boards.

A server allows Sapera LT applications to interact with the server's resources.

What is a static resource?

Resources attached to a physical device are called static resources. For example, a frame grabber can have an acquisition resource and a transfer resource. These resources can be manipulated to control a physical device through a Sapera LT server.

What is a dynamic resource?

A dynamic resource is an abstract representation of data storage (such as a buffer, lookup table, and so forth), or links that connect the data storage to static resources. Unlike static resources, dynamic resources are not dependent on physical devices; therefore, users on a specified server can freely create dynamic resources.

What is a module?

A module is a set of functions used to access and/or control a static or a dynamic resource. The complete Sapera LT Standard C API is composed of a series of modules organized in a particular architecture. See the *Sapera Basic Modules Reference Manual* for details.

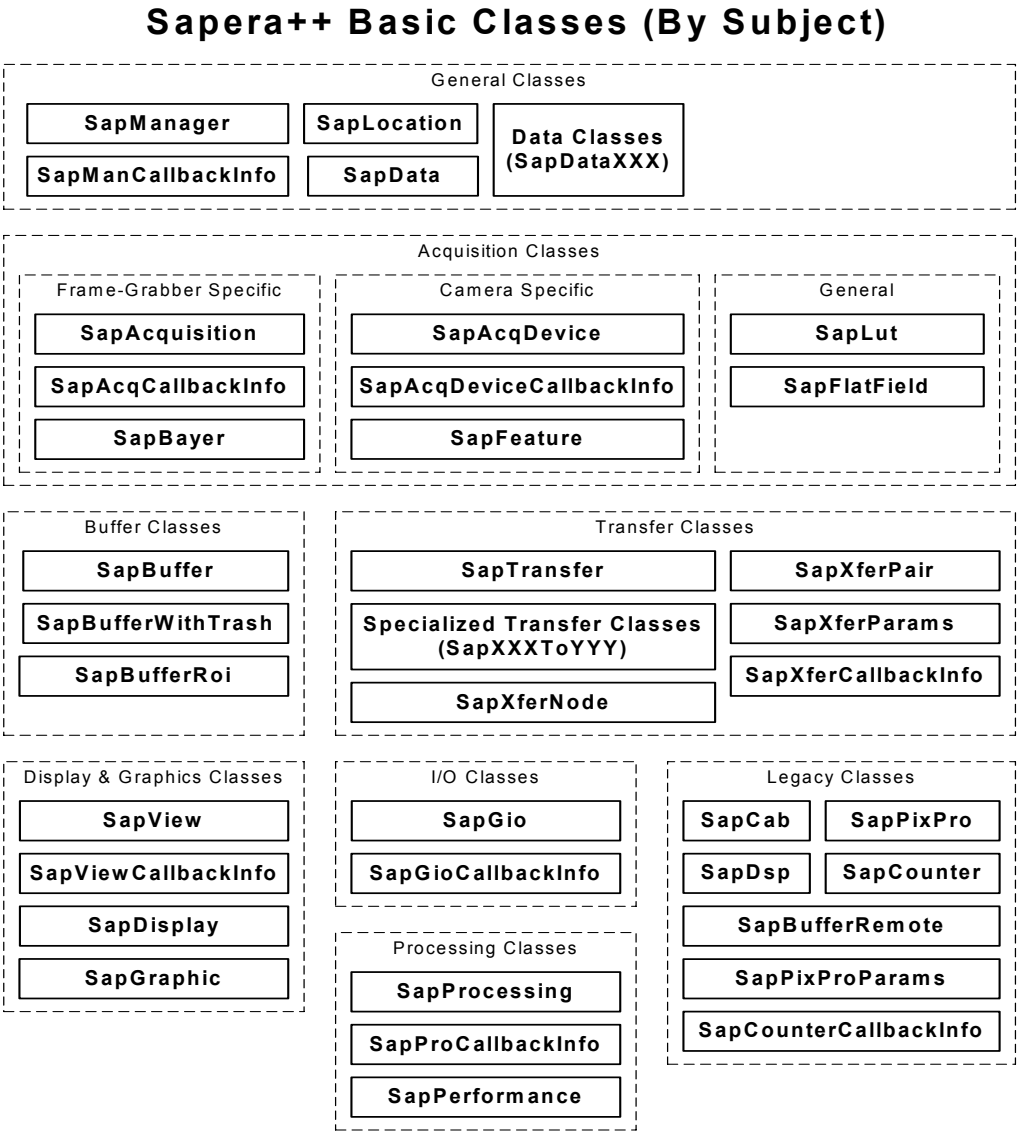
Sapera++ encapsulates all of these concepts in a series of C++ classes that offer the following benefits compared to the Standard API

- Easier server management
- Consistent programming interface for static and dynamic resources
- Grouping of modules inside one class whenever appropriate

See the *Sapera++ Programmer's Manual* for a hierarchy chart of all the Sapera++ classes.

Description of Sapera++ Classes

Below is a diagram along with a brief description of the main Sapera++ classes that implement access to the Standard API module resources, as well as their relationship to other classes.



SapAcquisition Class

The SapAcquisition class includes the functionality to control an acquisition device on any DALSA board that supports an acquisition section (for example, X64-CL). It is used as a source transfer node to allow data transfers from an acquisition resource to another transfer node, such as SapBuffer, SapCab, SapDsp, or SapPixPro. It is used by the SapTransfer class.

SapAcqDevice Class

The SapAcqDevice class includes the functionality to control an acquisition device on any DALSA camera (for example, Genie M640). It is used as a source transfer node to allow data transfers from an acquisition resource to another transfer node, such as SapBuffer. It is used by the SapTransfer class.

SapBuffer Class

The SapBuffer class includes the functionality to manipulate an array of buffer resources. A SapBuffer object can be used by a SapTransfer object as a destination transfer node to allow data transfers from a source node, such as SapAcquisition, SapDsp, SapPixProcessor, SapCab, or another SapBuffer. It may also be used as a source transfer node to allow transferring data to another SapBuffer or a SapCab.

A SapBuffer object can be displayed using the SapView class and processed using the SapProcessing class. It may also be the destination of graphic drawing operations through the SapGraphic class.

SapCab Class

The SapCab class includes the functionality to manipulate a CAB resource. It may be used by a SapTransfer object as a destination transfer node to allow data transfer from a source node, such as SapAcquisition, SapBuffer, SapDsp, SapPixPro, or another SapCab. It may also be used as a source transfer node to allow data transfers to a SapBuffer or another SapCab.

For more information, consult the *Sapera CAB Programmer's Manual*.

SapCounter Class

The purpose of the SapCounter class is to count events. These events can be external, such as a user supplied signal, or internal, such as a hardware clock. The counter may then be used as a reference to control events, such as changing the state of a general I/O at a specific time (together with the SapGio class). It may also be used to timestamp acquired images (SapBuffer objects), or to monitor the progression of an application (by simply reading the counter value).

SapDisplay Class

The SapDisplay class includes functionality to manipulate a display resource on the system display device (your computer video card) or any DALSA board supporting a display section. There is at least one such resource for each display adapter (VGA board) in the system.

Note that SapView objects automatically manage an internal SapDisplay object for the default display resource. However, you must explicitly manage the object yourself if you need a display resource other than the default one.

SapFeature Class

The SapFeature class includes the functionality to retrieve the feature information from the SapAcqDevice class. Each feature supported by the SapAcqDevice class provides a set of capabilities such as name, type, access mode, and so forth, that can be obtained through the feature module.

SapGio Class

The purpose of the SapGio class is to control a block of general inputs and outputs, that is, a group of I/Os that may be read and/or written all at once. This class may be used together with SapCounter to associate event counting with the state of specific I/O pins.

SapGraphic Class

The SapGraphic class implements the drawing of graphic primitives and text strings. It supports these operations either destructively on image data itself (using the Standard API graphic module), or in non-destructive overlay over displayed images (using Windows GDI functions).

SapLut Class

The SapLut class implements lookup table management. It is usually used together with the SapAcquisition and SapView classes to respectively manipulate acquisition and display lookup tables.

SapPixPro Class

The SapPixPro class includes the functionality to manipulate resources on a pixel processor device, that is, a daughter card that plugs into certain DALSA boards. The Pixel Processor is often used for applying simple pre-processing to an image. It is used by a SapTransfer object as an intermediate transfer node to allow data transfers from an acquisition resource to another transfer node, such as SapBuffer or SapCab.

SapTransfer Class

The SapTransfer class implements functionality for managing a generic transfer process, that is, the action of transferring data from one source node to a destination node.

All the following classes are considered to be transfer nodes: SapAcquisition, SapBuffer, SapCab, SapDsp, and SapPixPro.

SapView Class

The SapView class includes the functionality to show the resources of a SapBuffer object in a window through a SapDisplay object. An ‘auto empty’ mechanism allows synchronization between SapView and SapTransfer objects in order to show buffers in realtime without missing any data.

Sapera++ also includes classes that implement access either to a subset of the functionality of a Standard C API resource, or to functionality taken from two or more Standard C API resources. There are also some classes that are completely independent of this lower layer.

Data Classes

SapData and its derived classes act as wrappers for low-level Sapera LT data types, where each class encapsulates one data element of a specific type. They are used as method arguments or return values in various Sapera++ classes.

SapAcqCallbackInfo Class

The SapAcqCallbackInfo class acts as a container for storing all arguments to callback functions for the SapAcquisition class.

SapAcqDeviceCallbackInfo Class

The SapAcqDeviceCallbackInfo class acts as a container for storing all arguments to callback functions for the SapAcqDevice class.

SapBayer Class

The purpose of the SapBayer class is to support Bayer conversion on images acquired from a camera. It supports this functionality both from the acquisition hardware (if supported) or from a software implementation.

SapBufferRoi Class

The purpose of the SapBufferRoi class is to create a rectangular region of interest (ROI) inside an existing SapBuffer object. The ROI has the same origin and dimensions for all buffer resources in the object.

SapBufferWithTrash Class

The SapBufferWithTrash class creates an additional resource called the trash buffer used when transferring data in real-time applications.

The trash buffer is an emergency buffer used when the data transfer is faster than a processing task performed on the buffers. When processing is not fast enough to keep up with the incoming data, images are transferred temporarily into the trash buffer until stability is reestablished.

SapCounterCallbackInfo Class

The SapCounterCallbackInfo class acts as a container for storing all arguments to callback functions for the SapCounterclass.

SapFlatField Class

The purpose of the SapFlatField class is to perform flat-field correction on images acquired from a camera or loaded from a disk. It supports this functionality both from the acquisition hardware (if supported) or from a software implementation.

SapGioCallbackInfo Class

The SapGioCallbackInfo class acts as a container for storing all arguments to callback functions for the SapGio class.

SapLocation Class

The SapLocation class identifies a Sapera server/resource pair.

SapManager Class

The SapManager class includes methods for describing the Sapera resources present on the system. It also includes error management capabilities.

SapManCallbackInfo Class

The SapManCallbackInfo class acts as a container for storing all arguments to callback functions for the SapManager class.

SapPerformance Class

The SapPerformance class implements basic benchmarking functionality. It is used by the SapProcessing Class to evaluate the time it takes to process one buffer. You may also use it for your own benchmarking needs.

SapPixProParams Class

The SapPixProParams class acts as a container for storing pixel processor parameters used by the SapPixPro class.

SapProcessing Class

The SapProcessing class allows you implement your own processing through a derived class.

SapProCallbackInfo Class

The SapProCallbackInfo class acts as a container for storing all arguments to callback functions for the SapProcessing class.

Specialized Transfer Classes

The specialized transfer classes are a set of classes derived from SapTransfer that allow easy creation of the most commonly used transfer configurations.

SapViewCallbackInfo Class

The SapViewCallbackInfo class acts as a container for storing all arguments to callback functions for the SapView class.

SapXferCallbackInfo Class

The SapXferCallbackInfo class acts as a container for storing all arguments to callback functions for the SapTransfer class.

SapXferPair Class

The SapXferPair class describes a pair of source and destination nodes for the SapTransfer class.

SapXferParams Class

The SapXferParams class stores parameters needed by a transfer task managed by the SapTransfer class.

Introducing the Sapera LT API

The Three Sapera LT APIs

Three different APIs are available under Sapera LT:

1. Sapera++ classes (based on C++ language)
2. Sapera Standard API (based on C language)
3. Sapera ActiveX Controls (language independent)

The following sections demonstrate **Sapera++**. For C and ActiveX API information consult the *Sapera Basic Modules Reference Manual* and the *Sapera ActiveX Controls Programmer's Manual*, respectively.

Creating a Sapera++ Application

See the Using Sapera++ chapter of the Sapera++ Programmer's Manual for a description of the steps needed for creating a Sapera++ application.

Object initialization and cleanup

Sapera++ objects that encapsulate management of Standard API resources are initialized and refreshed in a uniform way, which consists of the following steps:

1. Allocate memory for the object
2. Create the resources needed by the object, through the Create method
3. Destroy the resources for the object, through the Destroy method
4. Release the memory for the object

There is more than one way to do this, as shown next for SapBuffer class objects:

```
// The usual way to create the object is through a pointer
SapBuffer *pBuffer = new SapBuffer(1, 512, 512);

if (pBuffer->Create())
{
   // Buffer object is correctly initialized
}

// Destroy the buffer resources after checking if it is still initialized
// through the 'operator BOOL' for the SapBuffer class
if (*pBuffer)
{
   pBuffer->Destroy();
}

// Release the object memory
delete pBuffer;
pBuffer = NULL;
```

```
// Create the object on the stack
SapBuffer buffer(1, 512, 512);

if (buffer.Create())
{
   // Buffer object is correctly initialized
   // Destroy the buffer resources
   buffer.Destroy();
}

// The object memory is automatically released when it goes out of scope
```

```
// Create the object from an existing object
SapBuffer buffer(1, 512, 512);
SapBuffer *pBuffer = new SapBuffer(buffer);

if (pBuffer->Create())
{
   pBuffer->Destroy();
}

// Release the object memory
delete pBuffer;
pBuffer = NULL;
```

Sapera++ objects that do not encapsulate management of Standard API resources are correctly initialized as soon as their constructor has been called

```
SapDataMono data(123);

// The object memory is automatically released when it goes out of scope
```

Error Management

Error reporting

Most Sapera++ methods return a Boolean TRUE/FALSE result to indicate success or failure. However, the actual errors conditions are still reported as soon as they happen, using one of five predefined reporting modes:

- Error messages are sent to a popup window (the default)
- Error messages are sent to the DALSA Log Viewer
- Error messages are sent to the active debugger if any
- Error messages are generated internally
- Error messages are sent to the application through a callback function

Use the SapManager::SetDisplayStatusMode method to set the current reporting mode, as follows:

```
// Send error messages to the Log Viewer
SapManager::SetDisplayStatusMode(SapManager::StatusLog);

// Send error messages to the debugger
SapManager::SetDisplayStatusMode(SapManager::StatusDebug);

// Simply generate error messages
SapManager::SetDisplayStatusMode(SapManager::StatusCustom);

// Send errors to application using a callback function
SapManager::SetDisplayStatusMode(SapManager::StatusCallback);

// Restore default reporting mode
SapManager::SetDisplayStatusMode(SapManager::StatusNotify);
```

Monitoring Errors

No matter which reporting mode is currently active, it is always possible to retrieve the latest error message. If the error happened when Sapera++ called a Standard API function, then a related numeric code is also available. In order the retrieve this information, call the SapManager::GetLastStatus method as follows:

```
// Get the latest error message
char errorDescr[256];
strcpy(errorDescr, SapManager::GetLastStatus());

// Get the latest error code
// See the Sapera Basic Modules Reference Manual for details
SAPSTATUS lastError;
SapManager::GetLastStatus(&lastError);
```

In addition, the DALSA Log Viewer utility program, included with Sapera LT, provides an easy way to view error messages. It includes a list box that stores these messages as soon as the errors happen. Available options allow you to modify the different fields for display.

During development, it is recommended to start the Log Viewer before your application and then let it run so it can be referred to any time a detailed error description is required. However, errors are also stored by a low-level service (running in the background), even if the utility is not running. Therefore, it is possible to run it only when a problem occurs with your application.

Capabilities and Parameters

Sapera++ already includes all the functionality necessary for most Sapera LT applications. However, some features are only available in the Standard API. Capabilities and parameters are of particular interest in this case. Together they define a resource's ability and current state.

See the *Sapera Basic Modules Reference Manual* for a description of all capabilities and parameters, and their possible values.

What is a Capability?

A capability, as its name implies, is a value or set of values that describe what a resource can do. Capabilities are used to determine the possible valid values that can be applied to a resource's parameters. They are read-only.

A capability can be obtained from a resource by using the GetCapability method in the corresponding class. See the *Sapera++ Programmer's Manual* for details

What is a Parameter?

A parameter describes a current characteristic of a resource. It can be read/write or read-only.

A parameter for a resource can be obtained or set by using the GetParameter and SetParameter methods in the corresponding class. See the *Sapera++ Programmer's Manual* for details.

Acquiring Images

Required Classes

You need three Sapera++ classes to initiate the acquisition process:

- **SapAcquisition or SapAcqDevice:** Use the SapAcquisition class if you are using a frame grabber; use the SapAcqDevice class if you are using a camera directly connected to your PC, such as a GigE or DCAM camera.
- **SapBuffer**: Used to store the acquired data. Should be created using the SapBuffer::TypeContiguous or SapBuffer::TypeScatterGather buffer type to enable the transfer (see "Working with Buffers" on page 61 for more information about contiguous memory and scatter-gather).
- **SapTransfer:** Used to link the acquisition device to the buffer and to synchronize the acquisition operations.

Frame-Grabber Acquisition Example

Steps to perform an acquisition

- Specify the acquisition device and corresponding camera configuration file, using the SapAcquisition class.
- Create a buffer in memory to store the acquired image, using the SapBuffer class.
- Allocate a view object to display the image, using the SapView class, if required.
- Allocate a transfer object to link the acquisition to the image buffer, using the SapTransfer class. A transfer callback function should be registered if images need to be processed and displayed while grabbing.
- Allocate the resources for all objects (acquisition, view, buffer, and transfer), using the respective Create function of the class used to create the objects.
- Grab images, using the SapTransfer class.
- Destroy all created resources, when grabbing is completed.

This sample code demonstrates how to grab a live image into a buffer allocated in system memory using the X64-CL board as an acquisition device. See "Appendix A: Support" on page 67 for a list of DALSA boards equipped with an acquisition section.

As shown in the example, acquiring an image requires one file (the CCF file) to configure the acquisition hardware. It defines both the characteristics of the camera and how it will be used with the acquisition hardware. Refer to the section "Using the CamExpert Tool" on page 11 for a discussion on how to generate this file. Resource parameters can also be accessed individually.

Once the acquisition module is initialized using the CCF file, a compatible buffer may be created using settings taken directly from the acquisition.

Before initiating the actual transfer, you must create a transfer object to link the acquisition and the buffer objects. Furthermore, when stopping a transfer, you must call the SapTransfer::Wait method to wait for the transfer process to terminate completely.

```
// Transfer callback function is called each time a complete frame is transferred
//
void XferCallback(SapXferCallbackInfo *pInfo)
{
   // Display the last transferred frame
   SapView *pView = (SapView *) pInfo->GetContext();
   pView->Show();
}
// Example program
//
main()
{
   // Allocate acquisition object
   SapAcquisition *pAcq =
      new SapAcquisition(SapLocation "X64-CL_1", 0), "MyCamera.ccf");

   // Allocate buffer object, taking settings directly from the acquisition
   SapBuffer *pBuffer = new SapBuffer(1, pAcq);

   // Allocate view object, images will be displayed directly on the desktop
   SapView *pView = new SapView(pBuffer, SapHwndDesktop);

   // Allocate transfer object to link acquisition and buffer
   SapTransfer *pTransfer = new SapTransfer(XferCallback, pView);
   pTransfer->AddPair(SapXferPair(pAcq, pBuffer));

   // Create resources for all objects
   BOOL success = pAcq->Create();
   success = pBuffer->Create();
   success = pView->Create();
   success = pTransfer->Create();
```

```
   // Start a continuous transfer (live grab)
   success = pTransfer->Grab();
   printf("Press any key to stop grab\n");
   getch();

   // Stop the transfer and wait (timeout = 5 seconds)
   success = pTransfer->Freeze();
   success = pTransfer->Wait(5000);
   printf("Press any key to terminate\n");
   getch();

   // Release resources for all objects
   success = pTransfer->Destroy();
   success = pView->Destroy();
   success = pBuffer->Destroy();
   success = pAcq->Destroy();

   // Free all objects
   delete pTransfer;
   delete pView;
   delete pBuffer;
   delete pAcq;

   return 0;
}
```

For more details, see the *Sapera++ Programmer's Manual* and the source code for the demos and examples included with Sapera LT.

Modifying the Frame-Grabber Parameters

Modifying Parameters Individually

Acquisition parameters can be modified individually by using the SapAcquisition::SetParameter method. When a new parameter value is requested, that value is verified against the current state of the acquisition module and the acquisition module capabilities. If the modification request is denied because the parameter is dependent on other parameters, then all the parameters in question must be modified by group.

```
// Allocate and create resources for acquisition object
SapAcquisition *pAcq =
   new SapAcquisition(SapLocation("X64-CL_1", 0), "MyCamera.ccf");
BOOL success = pAcq->Create();

// Try changing the sync source to Composite Sync
success = pAcq->SetParameter(CORACQ_PRM_SYNC, CORACQ_VAL_SYNC_COMP_SYNC);

// Release resources for acquisition object, and free it
success = pAcq->Destroy();
delete pAcq;
```

For more details, see the *Sapera++ Programmer's Manual* and the *Sapera Basic Modules Reference Manual*.

Triggered Acquisition Example

The following code sample demonstrates how to set individual parameters, using the SapAcquisition class SetParameter function, to perform a triggered acquisition (area scan camera). These parameters are set after creating your acquisition object and resources, and before grabbing.

```
   pAcq->SetParameter(CORACQ_PRM_EXT_TRIGGER_LEVEL, CORACQ_VAL_LEVEL_TTL);
   pAcq->SetParameter(CORACQ_PRM_EXT_TRIGGER_ENABLE, CORACQ_VAL_EXT_TRIGGER_ON);
   pAcq->SetParameter(CORACQ_PRM_EXT_TRIGGER_DETECTION, CORACQ_VAL_RISING_EDGE);
```

Modifying Parameters by Group

Acquisition parameters can be modified by groups using the optional *updateNow* parameter to the SapAcquisition::SetParameter method. When a new set of values is written, all modified parameters are verified against the given state and capabilities of the acquisition object.

```
// Allocate and create resources for acquisition object
SapAcquisition *pAcq =
   new SapAcquisition(SapLocation("X64-CL_1", 0), "MyCamera.ccf");
BOOL success = pAcq->Create();

// Try changing the cropping and scaling parameters
success = pAcq->SetParameter(CORACQ_PRM_CROP_WIDTH, 640, FALSE);
success = pAcq->SetParameter(CORACQ_PRM_CROP_HEIGTH, 480, FALSE);
success = pAcq->SetParameter(CORACQ_PRM_SCALE_HORZ, 640, FALSE);
success = pAcq->SetParameter(CORACQ_PRM_SCALE_VERT, 480, TRUE);

// Release resources for acquisition object, and free it
success = pAcq->Destroy();
delete pAcq;
```

For more details, see the *Sapera++ Programmer's Manual* and the *Sapera Basic Modules Reference Manual*.

Using an Input Lookup Table

When you call the Create method for a SapAcquisition object, an internal lookup table object (SapLut) is automatically created inside the object, if the acquisition hardware supports lookup tables.

You may then retrieve it using the SapAcquisition::GetLut method, manipulate it using the methods in the SapLut Class, and reprogram it using the SapAcquisition::ApplyLut method.

The internal SapLut object is automatically destroyed when you call the SapAcquisition::Destroy method.

```
// Allocate and create resources for acquisition object
SapAcquisition pAcq =
   new SapAcquisition(SapLocation("X64-CL_1", 0), "MyCamera.ccf");
BOOL success = pAcq->Create();

// Try changing the acquisition lookup table using a custom mapping
// The GetLut method returns NULL if there is no acquisition LUT
SapLut pLut = pAcq->GetLut();

// Allocate working memory for the new lookup table data
char *pNewData = new char[pLut->GetTotalSize()];
// Fill contents of data buffer …

// Write new data to lookup table
pLut->Write(0, pNewData, pLut->GetTotalSize());

// Program the acquisition hardware with the new LUT data
pAcq->ApplyLut();

// Free working memory
delete [] pNewData;

// Release resources for acquisition object, and free it
success = pAcq->Destroy();
delete pAcq;
```

Camera Acquisition Example

The camera acquisition example demonstrates how to grab a live image into a buffer allocated within system memory using the *Genie M640* camera as an acquisition device.

Acquiring an image can be performed either by using the camera default settings (feature values stored in the camera) or by loading a configuration file. The configuration file can be generated using *CamExpert*.

After the *SapAcqDevice* class is initialized (with or without using a configuration file), certain parameters are retrieved from it (acquisition width, height, and format) to create a compatible buffer.

Before starting the transfer, you must create a transfer path between the *SapAcqDevice* class and the *SapBuffer* class using one of the *SapTransfer's* derived classes (*SapAcqDeviceToBuf* in this case). Furthermore, when requesting a transfer stop, you must call *SapTransfer::Wait* to wait for the transfer process to terminate completely.

```
// Transfer callback function is called each time a complete frame is transferred
//
void XferCallback(SapXferCallbackInfo *pInfo)
{
   // Display the last transferred frame
   SapView *pView = (SapView *) pInfo->GetContext();
   pView->Show();
}

// Example program
//
main()
{
   // Allocate acquisition object
   SapAcqDevice *pAcq =
      new SapAcqDevice("Genie_M640_1", FALSE);  // uses camera default settings
      //new SapAcqDevice("Genie_M640", "MyCamera.ccf");  // loads configuration file

   // Allocate buffer object, taking settings directly from the acquisition
    SapBuffer *pBuffer = new SapBuffer(1, pAcq);

   // Allocate view object to display in an internally created window
   SapView *pView = new SapView(pBuffer, (HWND)-1);

   // Allocate transfer object to link acquisition and buffer
   SapAcqDeviceToBuf *pTransfer =
      new SapAcqDeviceToBuf(pAcq, pBuffer, XferCallback, pView);

   // Create resources for all objects
   BOOL success = pAcq->Create();
   success = pBuffer->Create();
   success = pView->Create();
   success = pTransfer->Create();
```

```
   // Start a continuous transfer (live grab)
   success = pTransfer->Grab();
   printf("Press any key to stop grab\n");
   getch();

   // Stop the transfer and wait (timeout = 5 seconds)
   success = pTransfer->Freeze();
   success = pTransfer->Wait(5000);
   printf("Press any key to terminate\n");
   getch();

   // Release resources for all objects
   success = pTransfer->Destroy();
   success = pView->Destroy();
   success = pBuffer->Destroy();
   success = pAcq->Destroy();

   // Free all objects
   delete pTransfer;
   delete pView;
   delete pBuffer;
   delete pAcq;

   return 0;
}
```

Modifying the Camera Features

The following section describes how to modify camera features individually or by group.

Accessing Feature Information and Values

The following example shows how features of the camera can be accessed. Information such as type, range and access mode can be retrieved for each supported feature. The *SapAcqDevice* class also allows modifying the feature values by directly writing to the camera. In some circumstances, a set of feature values are tightly coupled together and must be written to the camera at the same time. The next section shows how to proceed in such a case.

```
//
// Callback Function
//
void CameraCallback(SapAcqDeviceCallbackInfo* pInfo)
{
   BOOL status;
   int eventCount;
   int eventIndex;
   char eventName[64];

   // Retrieve count, index and name of the received event
   status = pInfo->GetEventCount(&eventCount);
   status = pInfo->GetEventIndex(&eventIndex);
   status = pInfo->GetAcqDevice()->GetEventNameByIndex(eventIndex, eventName,
            sizeof(eventName));

   // Check for "FeatureChanged" event
   if (strcmp(eventName, "FeatureChanged") == 0)
   {
      // Retrieve index and name of the feature that has changed
      int featureIndex;
      char featureName[64];
      status = pInfo->GetFeatureIndex(&featureIndex);
      status = pInfo->GetAcqDevice()->GetFeatureNameByIndex(featureIndex, featureName,
               sizeof(featureName));
   }
}

//
// Main Program
//
main()
{
   BOOL status;

   // Create a camera object
   SapAcqDevice camera("Genie_M640_1");
   status = camera.Create();

   // Get the number of features provided by the camera
   int featureCount;
   status = camera.GetFeatureCount(&featureCount);

   // Create an empty feature object (to receive information)
   SapFeature feature("Genie_M640_1");
   status = feature.Create();

   //
   // Example 1 : Browse through the feature list
   //
   int featureIndex;
   for (featureIndex = 0; featureIndex < featureCount; featureIndex++)
   {
      char featureName[64];
      SapFeature::Type featureType;

      // Get information from current feature
      // Get feature object
      status = camera.GetFeatureInfo(featureIndex, &feature);

      // Extract name and type from object
```

```
      status = feature.GetName(featureName, sizeof(featureName));
      status = feature.GetType(&featureType);

      // Get/set value from/to current feature
      switch (featureType)
      {
         // Feature is a 64-bit integer
      case SapFeature::TypeInt64:
         {
            UINT64 value;
            status = camera.GetFeatureValue(featureIndex, &value);
            value += 10;
            status = camera.SetFeatureValue(featureIndex, value);
         }
         break;

         // Feature is a boolean
      case SapFeature::TypeBool:
         {
            BOOL value;
            status = camera.GetFeatureValue(featureIndex, &value);
            value = !value;
            status = camera.SetFeatureValue(featureIndex, value);
         }
         break;

         // Other feature types
         // ...
      }
   }

   //
   // Example 2 : Access specific feature (integer example)
   //
   // Get feature object
   status = camera.GetFeatureInfo("Gain", &feature);

   // Extract minimum, maximum and increment values
   UINT32 min, max, inc;
   status = feature.GetMin(&min);
   status = feature.GetMax(&max);
   status = feature.GetInc(&inc);

   // Read, modify and write value
   UINT32 value;
   status = camera.GetFeatureValue("Gain", &value);
   value += 10;
   status = camera.SetFeatureValue("Gain", value);

   //
   // Example 3 : Access specific feature (enumeration example)
   //
   // Get feature object
   status = camera.GetFeatureInfo("GainMode", &feature);

   // Get number of items in enumeration
   int enumCount;
   status = feature.GetEnumCount(&enumCount);

   int enumIndex, enumValue;
   char enumStr[64];
   for (enumIndex = 0; enumIndex < enumCount; enumIndex++)
```

```
   {
      // Get item string and value
      status = feature.GetEnumString(enumIndex, enumStr, sizeof(enumStr));
      status = feature.GetEnumValue(enumIndex, &enumValue);
   }

   // Read a value and get its associated string
   status = camera.GetFeatureValue("GainMode", &enumValue);
   status = feature.GetEnumStringFromValue(enumValue, enumStr, sizeof(enumStr));

   // Write a value corresponding to known string
   status = feature.GetEnumValueFromString("GainModeOnePush", &enumValue);
   status = camera.SetFeatureValue("GainMode", enumValue);

   //
   // Example 4 : Access specific feature (LUT example)
   //
   // Select a LUT and retrieve its size and format
   UINT32 lutIndex = 0, lutNEntries, lutFormat;
   status = camera.SetFeatureValue("LUT_Index", lutIndex);
   status = camera.GetFeatureValue("LUT_NEntries", &lutNEntries);
   status = camera.GetFeatureValue("LUT_Format", &lutFormat);

   // Create and generate a compatible software LUT
   SapLut lut(lutNEntries, lutFormat);
   status = lut.Create();
   status = lut.Reverse();

   // Write LUT values to camera
   status = camera.SetFeatureValue("LUT_Values", &lut);

   //
   // Example 5 : Callback management
   //
   // Browse event list
   int numEvents;
   status = camera.GetEventCount(&numEvents);

   int eventIndex;
   for (eventIndex = 0; eventIndex < numEvents; eventIndex++)
   {
      char eventName[64];
      status = camera.GetEventNameByIndex(eventIndex, eventName, sizeof(eventName));
   }

   // Register event by name
   status = camera.RegisterCallback("FeatureChanged", CameraCallback, NULL);

   // Modified a feature (Will trigger callback function)
   status = camera.SetFeatureValue("Gain", 150);

   // Unregister event by name
   status = camera.UnregisterCallback("FeatureChanged");
}
```

Writing Feature Values by Group

When a series of features are tightly coupled, they are difficult to modify without following a specific order. For example, a region-of-interest (ROI) has four values (OffsetX, OffsetY, Width and Height) that are inter-dependent and must be defined as a group. To solve this problem, the *SapAcqDevice* class allows you to temporarily set the feature values in an "internal cache" and then download the values to the camera at the same time. The following code illustrates this process using an ROI example.

```
…
// Set manual mode to update features
success = pAcq->SetUpdateFeatureMode(SapAcqDevice::UpdateFeatureManual);

// Set buffer left position (in the internal cache only)
success = pAcq->SetFeatureValue("OffsetX", 50);

// Set buffer top position (in the internal cache only)
success = pAcq->SetFeatureValue("OffsetY", 50);

// Set buffer width (in the internal cache only)
success = pAcq->SetFeatureValue("Width", 300);

// Set buffer height (in the internal cache only)
success = pAcq->SetFeatureValue("Height", 300);

// Write features to device (by reading values from the internal cache)
success = pAcq->UpdateFeaturesToDevice();

// Set back the automatic mode
success = pAcq->SetUpdateFeatureMode(SapAcqDevice::UpdateFeatureAuto);

…
```

For more details, see the *Sapera++ Programmer's Manual*.

Displaying Images

Required Classes

The following three Sapera++ classes are required to initiate a display process:

- **SapDisplay**: Manages the actual resources on the hardware display device.
- **SapBuffer**: Contains the data to display. Several type options may be chosen when allocating the buffer to be compatible with the different display modes (see "Working with Buffers" on page 61 for more information about these options).
- **SapView**: Links the display to the buffer and synchronizes the display operations.

Display Example

The example below illustrates how to display an image contained within a system buffer on the computer VGA card. The buffer is transferred to the Windows Desktop using the DIB mode (automatically detected by the SapView Class). When using this mode, a Windows Device-Independent Bitmap (DIB) is first created before being sent to VGA memory.

```
// Allocate and create a 640x480x8 buffer object
SapBuffer *pBuffer = new SapBuffer(1, 640, 480, SapFormatMono8);
BOOL success = pBuffer->Create();

// Allocate and create view object, images will be displayed directly on the desktop
SapView *pView = new SapView(pBuffer, SapHwndDesktop);
success = pView->Create();

// Display the image on the desktop
pView->Show();

// Release resources for all objects
success = pView->Destroy();
success = pBuffer->Destroy();

// Free all objects
delete pView;
delete pBuffer;
```

For more details, see the *Sapera++ Programmer's Manual*.

Displaying in a Windows Application

The SapView Class includes the three methods OnPaint, OnMove, and OnSize. When your Windows application is based on MFC, you should call these from within the OnPaint, OnMove, and OnSize handlers in your application program. This ensures that Sapera++ is aware about the changes to the display area.

However, these methods often do not offer, especially for scroll bars, a sufficient level of management following changes to the display area. So it is recommended that you use the methods with the same names in the CImageWnd Class instead. Note that this class is part of the GUI classes.

Here is a partial listing of a dialog-based Windows application using the Visual C++'s MFC library:

```
// Declarations from class header file
SapBuffer *m_pBuffer;
SapView *m_pView;
CImageWnd *m_ImageWnd;
// End declarations from class header file

CSaperaAppDlg::CSaperaAppDlg()
{
   m_pBuffer = NULL;
   m_pView = NULL;
   m_pImageWnd = NULL;

   // Other initialization
   ...
}

BOOL CSaperaAppDlg::OnInitDialog()
{
   // Call default handler
   CDialog::OnInitDialog();

   // Other initialization
   ...

   // Allocate and create a 640x480x8 buffer object
   *m_pBuffer = new SapBuffer(1, 640, 480, SapFormatMono8);
   BOOL success = m_pBuffer->Create();

   // Allocate and create view object, images will be displayed in the MFC CWnd
   // object identified by m_ViewWnd
   m_pView = new SapView(m_pBuffer, m_ViewWnd.GetSafeHwnd());
   success = m_pView->Create();

   // Create image window object. The m_HorizontalScr and m_VerticalScr arguments
   // are MFC CscrollBar objects representing the scroll bars.
   m_pImageWnd = new CImageWnd(m_pView, &m_ViewWnd,
                               &m_HorizontalScr, &m_VerticalScr, this);

   return TRUE;
}
```

```
CSaperaAppDlg::OnDestroy()
{
   // Release resources for all objects
   BOOL success = m_pView->Destroy();
   success = m_pBuffer->Destroy();

   // Free all objects
   delete m_pImageWnd
   delete m_pView;
   delete m_pBuffer;
}

void CSaperaAppDlg::OnPaint()
{
   if (IsIconic())
   {
   ...
   }
   else
   {
      // Call the default handler to paint a background
      CDialog::OnPaint();

      // Display last acquired image
      m_pImageWnd->OnPaint();
   }
}

void CSaperaAppDlg::OnSize(UINT nType, int cx, int cy)
{
   // Call default handler
   CDialog::OnSize(nType, cx, cy);

   // Make appropriate adjustment in image window
   m_pImageWnd->OnSize();
}

void CSaperaAppDlg::OnMove(int x, int y)
{
   // Call default handler
   CDialog::OnMove(x, y);

   // Make appropriate adjustment in image window
   m_pImageWnd->OnMove();
}
```

For more details, see the *Sapera++ Programmer's Manual* and the source code for the demos and examples included with Sapera LT.

Working with Buffers

Root and Child Buffers

A buffer object is created in one of two ways: either as a root SapBuffer object (with no parent) or as a child SapBufferRoi object (with a parent). The parent of the child may also be a child itself, which allows you to build a buffer hierarchy with no restriction on the number of levels. A SapBuffer object can have more than one child SapBufferRoi object.

A SapBufferRoi object shares the same memory space as its parent, and it defines an adjustable rectangular region of interest. A child may be used by acquisition to reduce bandwidth requirements, or by a processing function in order to process a specific region.

The example below illustrates how to create a parent buffer with two children.

Note: SapBufferRoi objects must be destroyed before their parent.

```
// Allocate and create a 640x480x8 buffer object
SapBuffer *pBuffer = new SapBuffer(1, 640, 480, SapFormatMono8);
BOOL success = pBuffer->Create();

// Allocate and create a 320x240 child in the upper-left corner
SapBufferRoi *pChild1 = new SapBufferRoi(pBuffer, 0, 0, 320, 240)
success = pChild1->Create();

// Allocate and create a 320x240 child in the upper-right corner
SapBufferRoi *pChild2 = new SapBufferRoi(pBuffer, 320, 0, 320, 240)
success = pChild2->Create();

// Use buffers
...

// Release resources for all objects
success = pBuffer->Destroy();
success = pChild1->Destroy();
success = pChild2->Destroy();

// Free all objects
delete pBuffer;
delete pChild1;
delete pChild2;
```

You may modify the origin and dimensions of the region of interest for a child buffer object before calling its Create method. The following example demonstrates this concept.

```
// Swap left and right children, and make their height the same as the parent
success = pChild1->SetRoi(320, 0, 320, 480);
success = pChild2->SetRoi(0, 0, 320, 480);
```

Buffer Types

You may create a SapBuffer object using one of many predefined types. This has an effect on how the actual buffer resources are allocated, and on how the object may be used with other classes, such as SapTransfer and SapView.

Contiguous Memory Buffers (SapBuffer::TypeContiguous)

Buffers are allocated in Sapera LT Contiguous Memory, which is one large chunk of non-pageable and non-moveable memory reserved by Sapera LT at boot time. Buffer data is thus contained in a single memory block (not segmented). These buffers may be used as source and destination for transfer resources.

Scatter-Gather Memory Buffers (SapBuffer::TypeScatterGather)

Buffers are allocated in noncontiguous memory (paged pool). Pages are locked in physical memory so that a scatter-gather list may be built. This allows allocation of very large buffers to be used as source and destination for transfer resources. The maximum amount of memory that may be allocated depends on available memory, the operating system, and the application(s) used. If the amount of system memory exceeds four GB, Sapera LT automatically uses TypeScatterGatherPhysical instead.

Virtual Buffers (SapBuffer::TypeVirtual)

Similar to TypeScatterGather, except that the memory pages are not locked. This allows allocation of very large buffers, but they cannot be used as source or destination for transfer resources.

Offscreen Buffers (SapBuffer::TypeOffscreen)

Buffers are allocated in system memory. SapView objects created using these buffers may use display adapter hardware to copy from the buffer to video memory. System memory offscreen buffers may be created using any pixel format, but calling the SapView::Show method will take longer to execute if the display hardware does not efficiently support its pixel format.

OffScreen Buffers in Video Memory (SapBuffer::TypeOffscreenVideo)

Buffers are allocated in offscreen video memory. SapView objects created using these buffers use display adapter hardware to perform a fast copy in video memory. These buffers are typically used when a graphical element is reused for several consecutive frames without modification. In this case, it is more efficient to keep this element in video memory and use display hardware capabilities.

Overlay Buffers (SapBuffer::TypeOverlay)

Buffers are allocated in video memory. Once you create SapView objects using these buffers and call their Show method one time, the display adapter overlay hardware will keep updating the display with the buffer contents with no additional calls The pixel format of overlay buffers must be supported by the display hardware. Typically, overlay buffers support more pixel formats (like YUV) than offscreen buffers. Also, color keying is supported for overlays. SapView Class determines the behavior of the overlay regarding key colors.

Dummy Buffers (SapBuffer::TypeDummy)

Dummy buffers do not have any data memory. They may be used as placeholders by transfer resources when there is no physical data transfer.

Physical Memory Buffers (SapBuffer::TypeUnmapped)

Buffers are allocated as a series of non-contiguous chunks of physical memory. You may not access their data until they have been mapped to virtual memory addresses using the SapBuffer::GetAddress method. This type of buffer is useful if the total amount of needed buffer data exceeds the amount of available virtual memory addresses (2 GB under Windows). To avoid a shortage of virtual memory addresses, use the SapBuffer::ReleaseAddress method as soon as you are done accessing their data. Note that you cannot acquire images into these buffers.

Physical Scatter-Gather Memory Buffers (SapBuffer::TypeScatterGatherUnmapped)

These buffers are similar to TypePhysical, except that you can acquire images into them.

Reading and Writing a Buffer

The simplest way to read or write data to a buffer resource is by accessing it element by element. The ReadElement and WriteElement methods fulfill this purpose. The following demonstrates how to access data in an 8-bit monochrome SapBuffer object.

```
// Allocate and create a 640x480x8 buffer object
SapBuffer *pBuffer = new SapBuffer(1, 640, 480, SapFormatMono8);
BOOL success = pBuffer->Create();

// Write a constant value in the buffer. SapDataMono is a Sapera++ class
// that encapsulates a Standard API monochrome data type.
success = pBuffer->WriteElement(100, 200, SapDataMono(128));

// Read back the value
SapDataMono data;
success = pBuffer->ReadElement(100, 200, &data);

// Release and free resources for SapBuffer object
success = pBuffer->Destroy();
delete pBuffer;
```

Accessing buffer data in this way is quite straightforward, but, unfortunately, it considerably slows down access time. Alternately, you can access data by reading/writing an array of elements with only one function call through the Read and Write methods. Here is a sample of their usage.

```
// Allocate and create a 640x480x8 buffer object
SapBuffer *pBuffer = new SapBuffer(1, 640, 480, SapFormatMono8);
BOOL success = pBuffer->Create();

// Create an array large enough to hold all buffer data
int size = 640 * 480 * sizeof(BYTE);
BYTE *dataBuf = new BYTE [size];

// Fill array with some values
...

// Write array to buffer resource
success = pBuffer->Write(0, size, dataBuf);

// Read back buffer data
success = pBuffer->Read(0, size, dataBuf);

// Release and free resources for SapBuffer object
success = pBuffer->Destroy();
delete pBuffer;

// Free the data buffer
delete dataBuf;
```

Although this is faster than the previous method, performance is still an issue because of the data copying operations involved.

The fastest way to access buffer data is to obtain direct access through a pointer. The GetAddress and ReleaseAddress methods initiate and end direct data access, respectively . The drawback of this method is that you need to know the buffer dimensions, format, and pitch in order to correctly access the data. The following code illustrates this.

```
// Allocate and create a 640x480 RGB 5-6-5 buffer object in offscreen video memory
SapBuffer *pBuffer =
   new SapBuffer(1, 640, 480, SapFormatRGB565, SapBuffer::TypeOffscreenVideo);
BOOL success = pBuffer->Create();

// Get the buffer pitch in bytes
int pitch = pBuffer->GetPitch();

// Get the buffer data address
BYTE *pData;
success = pBuffer->GetAddress(&pData);

// Access the buffer data
for (int lineNum = 0; lineNum < 480; lineNum++)
{
   WORD *pLine = (WORD *) (pData + lineNum * pitch);
   for (pixelNum = 0; pixelNum < 640; pixelNum++)
   {
      // Process the current line
   }
}

// End direct data access (pointer will then be invalid)
success = pBuffer->ReleaseAddress(pData);

// Release and free resources for SapBuffer object
success = pBuffer->Destroy();
delete pBuffer;
```

For more information on buffer data access functionality, see the *Sapera++ Programmer's Manual*.

Appendix A: Support

Supported Operating Systems

- Microsoft Windows® 2000
- Windows XP®

Supported DALSA Devices

This section lists the current set of DALSA devices supported under Sapera LT. Consult the DALSA web site for product descriptions. Consult the user's manual for each device for a detailed description of the supported features.

Frame-Grabbers

- Bandit-II Series
- Bandit-3 Series
- PC2 Series
- Viper Series
- X64 Series

Processing Boards

- Anaconda Series

Cameras

- Genie Series

System Support

The Sapera LT system server represents Sapera LT functionality running on the Host processor when no DALSA device is present. This section describes the resources available for this server.

Servers and Resources

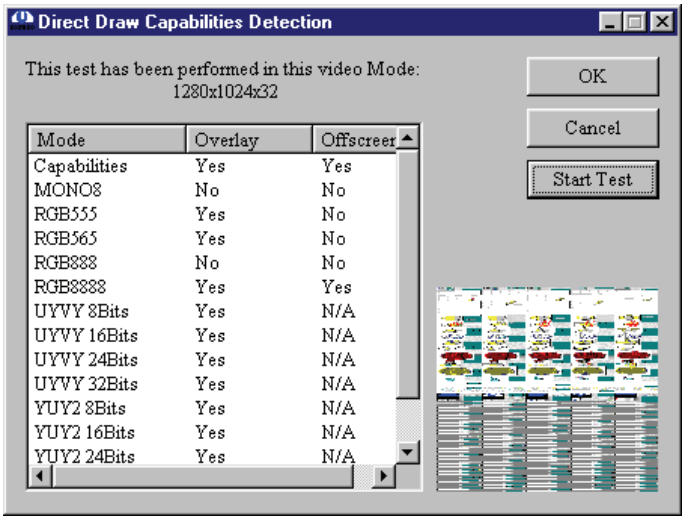
Servers		Resources		
Name	**Description**	**Type**	**Index: Name**	**Description**
System	System server	Display	0: Default display	Computer video card
		Graphic	0: Default graphic	Computer processor
		File	N/A	N/A
		Buffer	N/A	N/A
		Lut	N/A	N/A
		View	N/A	N/A

Appendix B: Other Tools

DirectDraw Capabilities Detection Tool

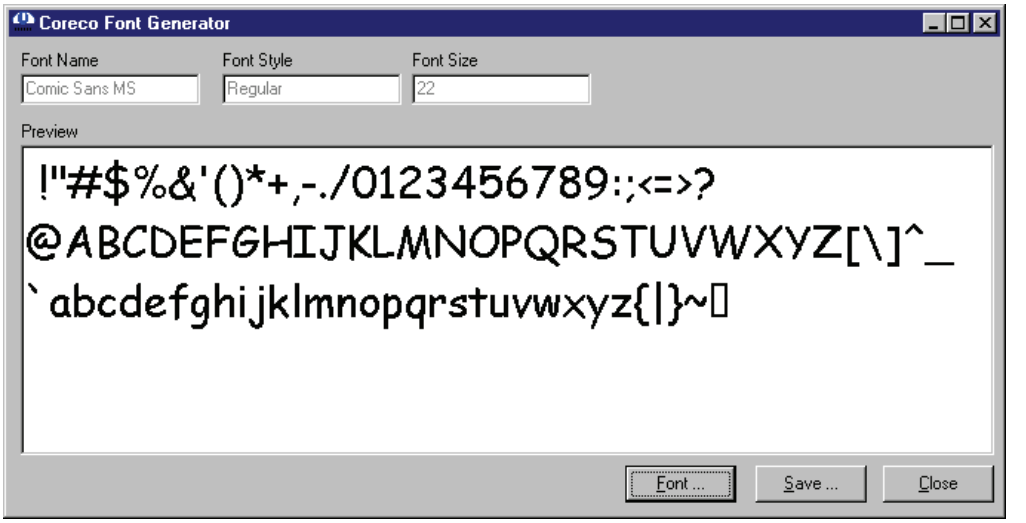
Use the *DirectDraw Capabilities Detection* tool to determine what "DirectDraw" capabilities a VGA card supports. The resulting information can be used to help determine the application View mode to be used.

To run this program, select **DALSA DirectDraw Capabilities Detection** in the **Tools** folder of the **Sapera LT** menu**.** Click on the button **Start Test**. The program runs a series of tests to ascertain if your VGA card supports "Overlay" and "Offscreen" modes for the different display formats. The following screen shot illustrates an example of the outcome of the test.



Font Generator Tool

The **CorFont.exe** tool program included with Sapera LT provides an easy way to create new fonts that can then be used by the Graphic module.



You are allowed to modify the font attributes by clicking on the **Font** button. The preview window shows you what the font will look like. The font can then be saved as a Text File (.h) or a Binary File (.cfn). The font, if saved as a text file, can be included directly into your C/C++ source code while the font saved as a binary file must always be loaded from the disk. See the "CorGraphicSetFont" function and "Graphic Font File Format" description in the *Sapera Basic Modules Reference Manual* for more information about using fonts.

DALSA Diagnostic tool

Overview:

The DALSA Diagnostic Tool is a troubleshooting aid for Sapera LT and device driver installations. It can generate reports for all supported DALSA devices installed in the system. It does not provide reports for old device driver releases.

This tool generates a system diagnostic report as an XML file. This file can be sent to DALSA technical support when assistance is required.

Diagnostic Tool Features:

- Supported by all new DALSA device drivers.
- Creates an XML diagnostic report file listing relevant files and system registry entries:
    - Validity status after the diagnostic process for each item
    - Path where each file should be found
    - File name
    - File version (if available)
    - File creation date
    - Date of latest file modification
    - File size
    - File author (company name)
    - For registry keys: path, name, and value)
- View information in XML file with Internet Explorer.

Usage Guide:

When the diagnostic tool is run, the set of installed and supported DALSA device drivers is listed along with the current Sapera LT installation.

Four items are listed for each:

ENV_NAME:	Environment variable name related to the product.
NAME:	Name of the product.
FILE:	XML reference file name installed with the product.
PATH:	Path where the XML reference file is installed.

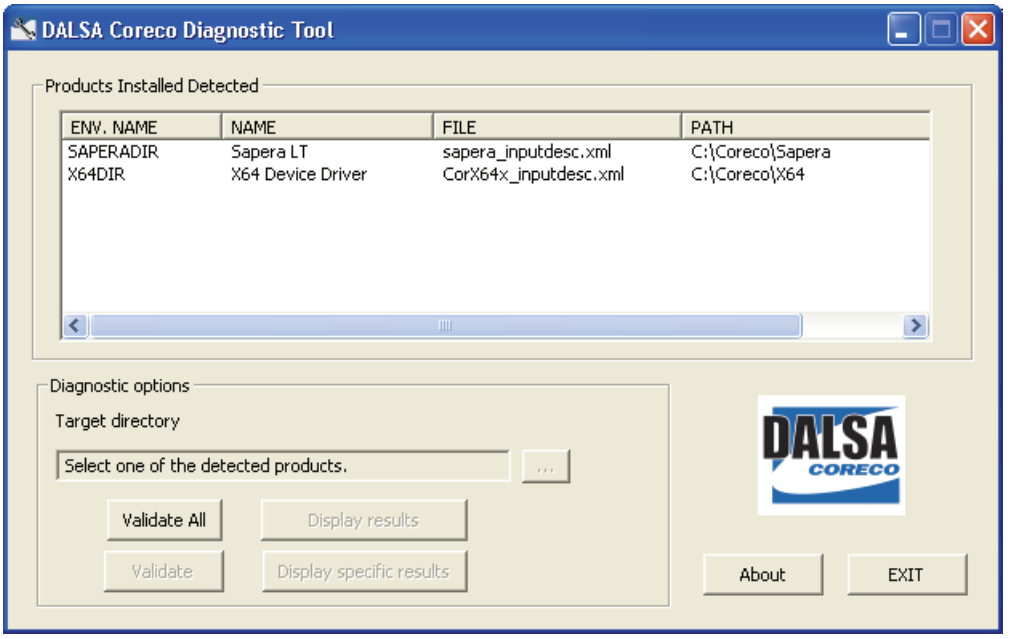
You may generate a diagnostic report on either a single product or all installed products.

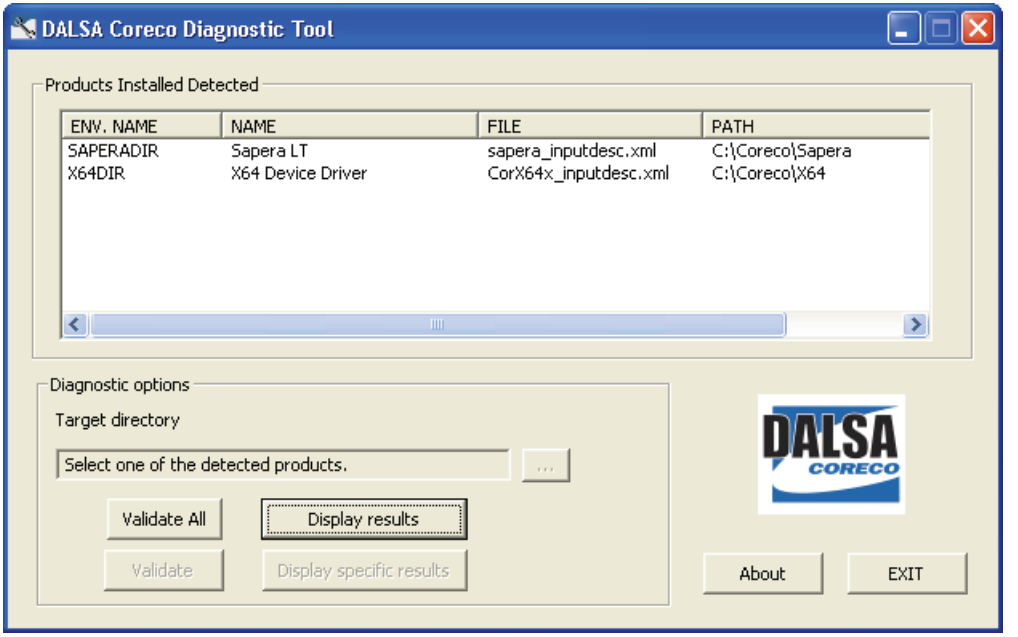
Validate All:

- Click **Validate All** to generate a diagnostic file (xml extension) containing an analysis of all listed products.
- At the end of diagnostic process, click the **Display Results** button to view the diagnostic file.

Validate:

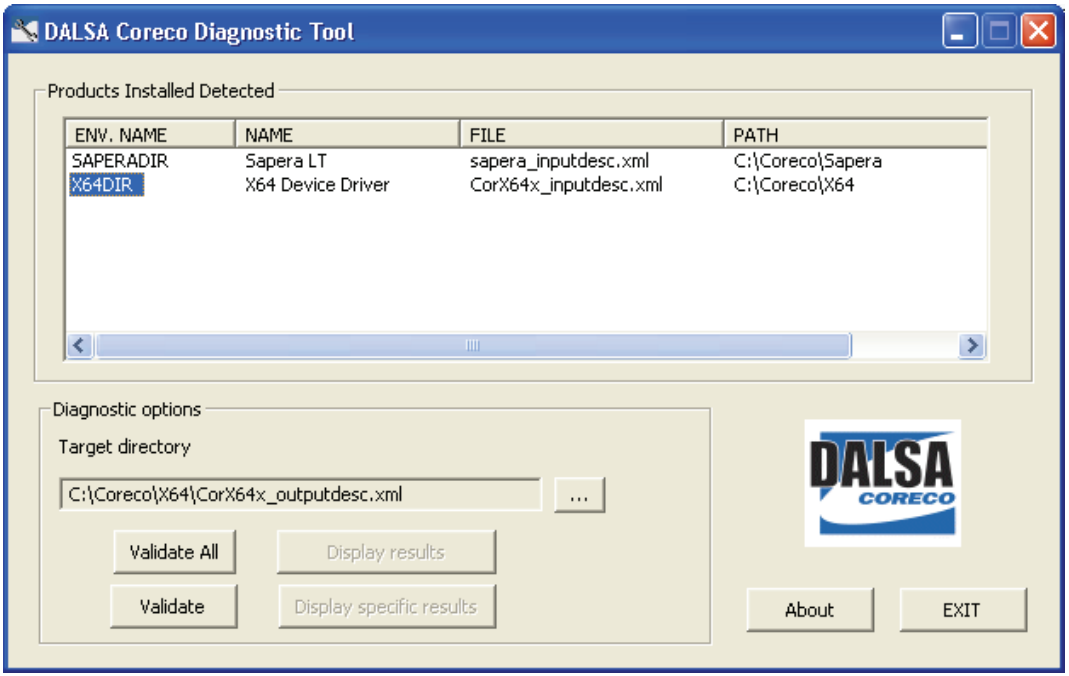
- Click **Validate** to generate a diagnostic file (xml extension) containing an analysis of the currently selected product.
- At the end of diagnostic process, click the **Display Results** button to view the diagnostic file.


DALSA Coreco Diagnostic Tool
Products Installed Detected
ENV. NAME
NAME
FILE
PATH
SAPERADIR
Sapera LT
sapera_inputdesc.xml
C:\Coreco\Sapera
X64DIR
X64 Device Driver
CorX64x_inputdesc.xml
C:\Coreco\X64
Diagnostic options
Target directory
Select one of the detected products.
...
Validate All
Display results
Validate
Display specific results
DALSA
CORECO
About
EXIT


DALSA Coreco Diagnostic Tool
Products Installed Detected
ENV. NAME
NAME
FILE
PATH
SAPERADIR
Sapera LT
sapera_inputdesc.xml
C:\Coreco\Sapera
X64DIR
X64 Device Driver
CorX64x_inputdesc.xml
C:\Coreco\X64
Diagnostic options
Target directory
Select one of the detected products.
...
Validate All
Display results
Validate
Display specific results
DALSA
CORECO
About
EXIT

Report File Directory:

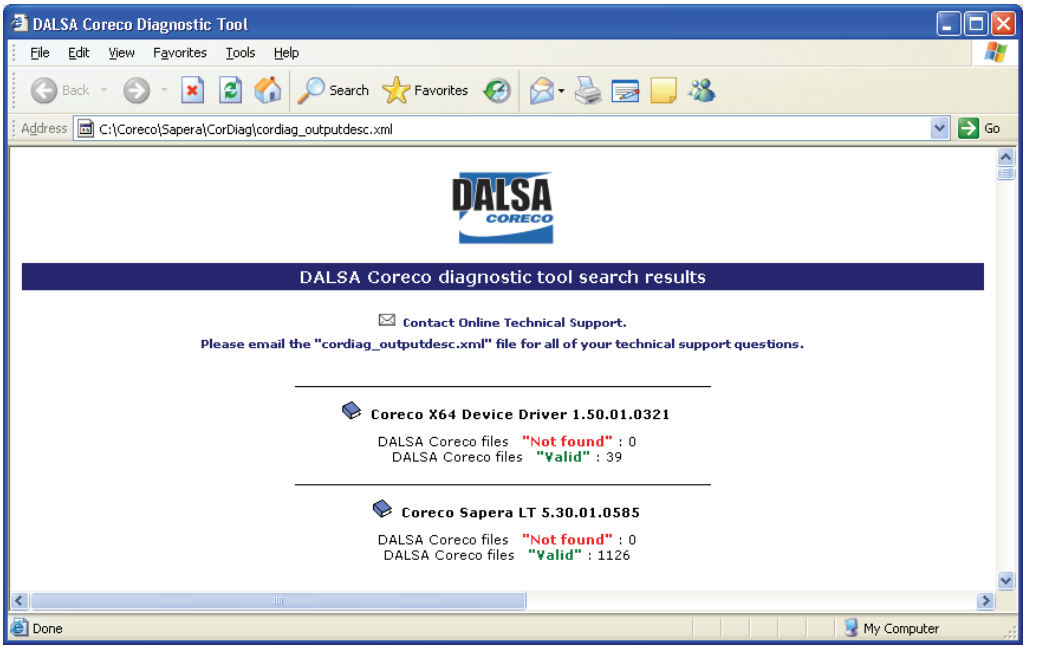
Before running either **validate** options, the report file name or directory can be changed from the default.

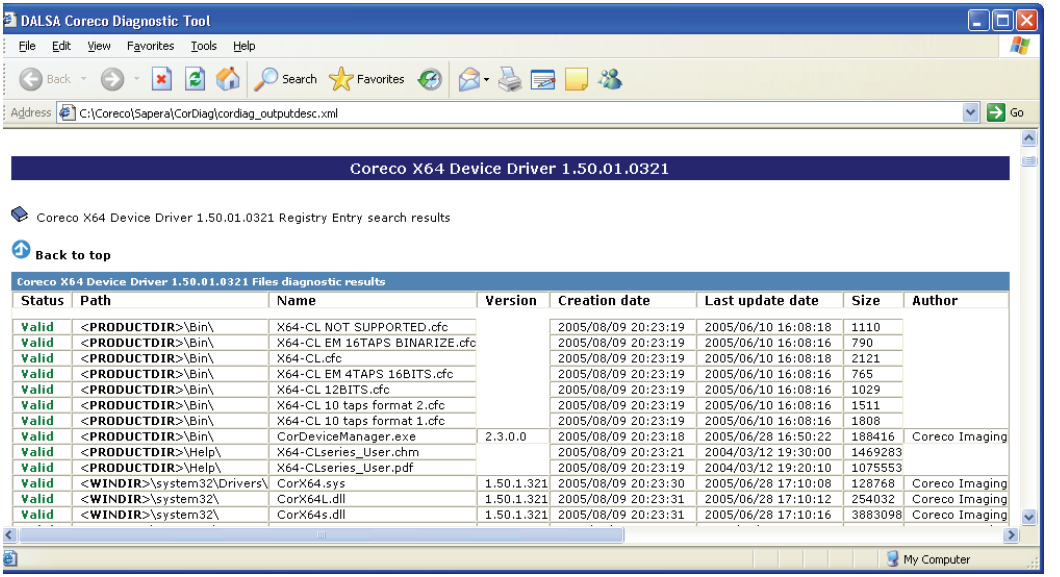


Sample Diagnostic XML file:

Important features of the diagnostic report are:

- Click **Contact Online Technical Support** to open a new Internet Explorer page that links to the "Contact Technical Support" page of the DALSA website. Follow the steps to request support and attach the diagnostic XML file.
- A summary lists the version numbers for installed products and gives separate counts for items with "Valid" and "Not Found" status.
- Click on any product name to jump directly to a detailed listing of this product.


DALSA Coreco Diagnostic Tool
File Edit View Favorites Tools Help
Back Search Favorites
Address C:\Coreco\Sapera\CorDiag\cordiag_outputdesc.xml
Go
DALSA
CORECO
DALSA Coreco diagnostic tool search results
Contact Online Technical Support.
Please email the "cordiag_outputdesc.xml" file for all of your technical support questions.
Coreco X64 Device Driver 1.50.01.0321
DALSA Coreco files "Not found" : 0
DALSA Coreco files "Valid" : 39
Coreco Sapera LT 5.30.01.0585
DALSA Coreco files "Not found" : 0
DALSA Coreco files "Valid" : 1126
Done
My Computer


DALSA Coreco Diagnostic Tool
File Edit View Favorites Tools Help
Back Search Favorites
Address C:\Coreco\Sapera\CorDiag\cordiag_outputdesc.xml
Go
Coreco X64 Device Driver 1.50.01.0321
Coreco X64 Device Driver 1.50.01.0321 Registry Entry search results
Back to top
Coreco X64 Device Driver 1.50.01.0321 Files diagnostic results
Status Path Name Version Creation date Last update date Size Author
Valid <PRODUCTDIR>\Bin\ X64-CL NOT SUPPORTED.cfc 2005/08/09 20:23:19 2005/06/10 16:08:18 1110
Valid <PRODUCTDIR>\Bin\ X64-CL EM 16TAPS BINARIZE.cfc 2005/08/09 20:23:19 2005/06/10 16:08:16 790
Valid <PRODUCTDIR>\Bin\ X64-CL.cfc 2005/08/09 20:23:19 2005/06/10 16:08:18 2121
Valid <PRODUCTDIR>\Bin\ X64-CL EM 4TAPS 16BITS.cfc 2005/08/09 20:23:19 2005/06/10 16:08:16 765
Valid <PRODUCTDIR>\Bin\ X64-CL 12BITS.cfc 2005/08/09 20:23:19 2005/06/10 16:08:16 1029
Valid <PRODUCTDIR>\Bin\ X64-CL 10 taps format 2.cfc 2005/08/09 20:23:19 2005/06/10 16:08:16 1511
Valid <PRODUCTDIR>\Bin\ X64-CL 10 taps format 1.cfc 2005/08/09 20:23:19 2005/06/10 16:08:16 1808
Valid <PRODUCTDIR>\Bin\ CorDeviceManager.exe 2.3.0.0 2005/08/09 20:23:18 2005/06/28 16:50:22 188416 Coreco Imaging
Valid <PRODUCTDIR>\Help\ X64-CLseries_User.chm 2005/08/09 20:23:21 2004/03/12 19:30:00 1469283
Valid <PRODUCTDIR>\Help\ X64-CLseries_User.pdf 2005/08/09 20:23:19 2004/03/12 19:20:10 1075553
Valid <WINDIR>\system32\Drivers\ CorX64.sys 1.50.1.321 2005/08/09 20:23:30 2005/06/28 17:10:08 128768 Coreco Imaging
Valid <WINDIR>\system32\ CorX64L.dll 1.50.1.321 2005/08/09 20:23:31 2005/06/28 17:10:12 254032 Coreco Imaging
Valid <WINDIR>\system32\ CorX64s.dll 1.50.1.321 2005/08/09 20:23:31 2005/06/28 17:10:16 3883098 Coreco Imaging
My Computer

Appendix C: Sapera LT Runtimes

Introduction

Once your application is ready to be delivered, you may need to create a procedure that will install the appropriate component to the target system. The following section details the tasks that your installation program needs to perform.

The appropriate device driver must be installed along with the installation of the Sapera LT runtimes. This topic is further discussed in this section.

Installing Sapera LT Runtimes and Sapera LT Compatible Drivers

The Sapera LT Installation Program automatically handles the task of copying files and making Windows Registry changes, as dictated by your selection of Sapera LT (full development or runtime components only) and the selected device drivers. When integrating Sapera LT and the Sapera LT device driver installations into your system, DALSA suggests that the Sapera LT Install Program be invoked within your own software installation program.

The Sapera LT installation is supplied in two forms: Developer and Runtime installations. The Developer installation is accessible from the Sapera LT CD browser and contains all Sapera LT components (demos, tools, documentation, and the Sapera LT runtimes). The Runtime version contains only the components required to execute your application. It is recommended that you install the Runtime components only on systems not used for development. You will find the Sapera LT installation in the **Sapera LT\Runtime** directory on the Sapera LT CD.

Unlike the Sapera LT installation, there is only one way to perform Sapera LT driver installations. A driver installation contains the device driver, the device's user's manual and, in some cases, some device specific demos.

Usually, the installation files are contained in one directory (for example, \Disk1). Sometimes, however, they are packaged in several directories (\Disk1, \Disk2, ….). In this case, you may include the installation files on your CD using this same directory structure. The subdivided directories can also be merged into one single directory; however, any sub-directories that the install directories

(\Disk1, \Disk2…) have within must remain unchanged. Do not merge their content into the main install directory.
For example this directory tree

when merged would become

DALSA Installers

Both Sapera LT and the driver installations share the same installer technology. As a result, the following discussion applies to both.

Note: You must reboot after the installation of Sapera LT. However, to streamline the installation process, you may install Sapera LT (without rebooting), the required device drivers and then reboot.

DALSA's installers can be started in two ways:

1. Normal Mode
   This is the interactive mode provided by default. It is initiated by invoking the **setup.exe** program. The installation proceeds normally as if it was started from Windows Explorer or the Windows command line.
2. Silent Mode
   This mode requires no user interaction. Any user input is provided through a "response" file. Nothing is displayed by the installer.

Note: During driver installation, Windows Digital Signature and Logo Testing warnings can be safely ignored.

Silent Mode Installation

Silent Mode installation is recommended when integrating DALSA products into your software installation. It provides a seamless installation with minimal effort.

Creating a response file

The “response” file is an “ASCII” file that is similar in content to Windows “INI” files. It can be generated automatically by the installer when invoked as follows:

```
setup -r
```

The installer will create a “response” file (SETUP.ISS) in the Windows directory that will reflect the choices you have made during the installation.

Running a Silent Mode Installation

The silent mode installation is started by invoking the installer as follows:

<path1>\setup -s –SMS -f1<path2>\setup.iss

The -F1 switch specifies the location of the response file.

Every file (including **setup.exe**) that belongs to disk 1 of the installation disk set must be in the same directory. If there is more than one disk, you have two ways to organize your source disk:

1. Put all files into one directory
2. Store the content of each disk in a separate directory. The directory should be named according to the following convention: \disk1, \disk2,…

DALSA Contact Information

Sales Information

Visit our web site:	http://www.imaging.com
Email:	info@dalsa-coreco.com

International/Canada

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Building 8, Floor 2
900 Middlesex Turnpike
Billerica, MA 01821

Tel: (978) 670-2000
Fax: (978) 670-2010

Technical Support

Any support question or request can be submitted via our web site:

Technical support form via our web page: Support requests for imaging product installations, Support requests for imaging applications	http://www.imaging.com/support
Camera support information	http://www.imaging.com/camsearch
Product literature and driver updates	http://www.imaging.com/download

When encountering hardware or software problems, please have the following documents included in your support request:

- The DALSA Diagnostic Tool XML report file
- The DALSA Log Viewer .txt file
- The PCI Diagnostic PciDump.txt file
- The DALSA Device Manager BoardInfo.txt file

Note, all these tools are available from the Windows start menu shortcut **Start•Programs•DALSA•Sapera LT•Tools**.

Glossary of Terms

ADC

Analog-to-digital converter.

Chroma

The color portion of the composite NTSC or PAL video signal. Luma is the black-and-white portion of the signal. Often used interchangeably with Chrominance, although this is technically incorrect.

CMYK

A color model in which all colors are composed of varying intensities of the primary subtractive colors: Cyan, Magenta, Yellow, and black. This color model is often used in print processing.

Color Key

Color keying is a method used to decide the source of a display pixel on the screen. If the graphics pixel on the VGA screen has the pixel value of the color key, then the corresponding pixel in the designated buffer will be displayed; otherwise, the VGA screen's pixel will be displayed.

Complex Parameter

A parameter with a size greater than a UINT32.

Composite Video

A single signal that includes both color video and timing information. NTSC and PAL are composite video standards, while RGB is not.

Dead Pixel

A defective pixel that remains unlit on an LCD screen, monitor, camera charge-coupled device or CMOS sensor.

Decimation

A process whereby pixels are dropped from digitized video waveforms for quick-and-easy image scaling. If 100 pixels are produced by a waveform, but only 50 are stored or used, the video waveform has been decimated by a factor of 2:1.

DLL

Dynamic Link Library. The supplied DLLs form the software interface between a Windows application and the DALSA hardware device.

Element

A data unit within the buffer, which may or may not be a pixel.

Frame Buffer

A large unit of memory used to hold the image for display onscreen.

Grayscale

In image processing, the range of available brightness levels, displayed in shades of gray. In an 8-bit system, the gray scale contains values from 0 to 255.

Host Memory

The Windows system's random-access memory. Typically refers to a frame buffer allocated in the computer system's memory.

Interlaced

The standard television method of raster scanning, in which the image is the product of two fields, each of which is made up of the image's alternate lines (that is, one field is comprised of lines 1, 3, 5, and so forth, and the other is comprised of lines 2, 4, 6, and so forth).

Keying Color

The Windows color which is used as a switch to the frame buffer video. Wherever the keying color is drawn, it is replaced with video from the buffer.

Lookup Table, LUT

In image processing, the segment of memory that stores values for point processes. Input pixel values are those of the original image, while output values are those altered by the chosen point process. An input lookup table destructively modifies the stored image data, whereas the output lookup table simply receives the stored data and modifies it for output only.

Luma

The black-and-white portion of the composite NTSC or PAL video signal. Chroma is the color portion of the signal. Often used interchangeable with Luminance, although this is technically incorrect.

Monochrome

A video source with only one component, usually meant to refer to a black-and-white composite signal. A monochrome composite video source has no chroma information.

Noninterlaced

Video scanning method, in which all the lines in the frame are scanned out sequentially. Used in several different analog and digital video systems, including Progressive Scan analog cameras, digital video cameras and computer monitors.

NTSC

National Television Standards Committee. Color TV standard used in used in North America, Japan, and in several other jurisdictions. The interlaced video signal is composed of a total of 525 video lines at a frame rate of 30 Hz.

Paged Pool Memory

Regions located in operating system's kernel space from which memory blocks can be allocated and deallocated dynamically. A memory block allocated in the paged pool memory is segmented into several pages physically separated from each other. A page is a contiguous block of memory limited in size (for example, Windows NT allocates pages of 4KB).

PAL

Phase Alteration by Line. Color TV standard used in most of Europe and in several other jurisdictions. The interlaced video signal is composed of a total of 625 video lines at a frame rate of 25 Hz.

PCI

Peripheral Component Interconnect. The PCI local bus is a 32-bit high performance expansion bus intended for interconnecting add-in boards, controllers, and processor/memory systems.

Pixel

A single picture element, the smallest individual digital video component The number of pixels describes the number of digital samples taken of the analog video signal. The number of pixels per video line by the number of active video lines describes the acquisition image resolution. The binary size of each pixel (for example, 8 bits, 15 bits, 24 bits) defines the number of gray levels or colors possible for each pixel.

Raster

The pattern of lines traced by rectilinear scanning in display systems.

RGB

Red, Green, Blue. Commonly used to refer to a non-composite video standard which uses these three colors in combination to generate a color video image.

RS-170

The original United States standard for black and white television. Now commonly used to refer to monochrome analog video signals.

Scaling

The act of changing the effective resolution of an image.

SECAM

Sequentiel Couleur avec Mémoire, a TV standard similar to PAL, in which the chroma is FM modulated and the R'-Y and B'-Y signals are transmitted line sequentially. Used primarily in France and Russia as well as in several other French-speaking and former Warsaw Pact countries.

Service

Functionality derived from a particular software program. For example, network services may refer to programs that transmit data or provide conversion of data in a network.

Simple Parameter

A parameter with a size less than or equal to a UINT32.

Stride

The memory distance between two pixels that are viewed as vertically adjacent in the image.

S-Video

Separate video, also known as Y/C video, which supports separate luma (Y) and chroma (C) video inputs and outputs. Often used interchangeably with S-VHS, which is technically incorrect.

Sync

The basic piece of information which tells a video display (TV or computer monitor) where to put the picture. Horizontal sync, or HSYNC, controls the left-right dimension and vertical sync, or VSYNC controls the top-to-bottom dimension.

Tearing

A display artifact caused by the fact that the video display will read frame buffer memory asynchronously to the incoming video stream. Tearing is non-data destructive.

Video Input Conditioning , VIC

The act of modifying an analog video signal via bandwidth filtering or gain amplification.

Y/C

See S-Video.

YUV

A common color space used in composite video color systems. Y is the luma component while U and V are the color difference components.

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